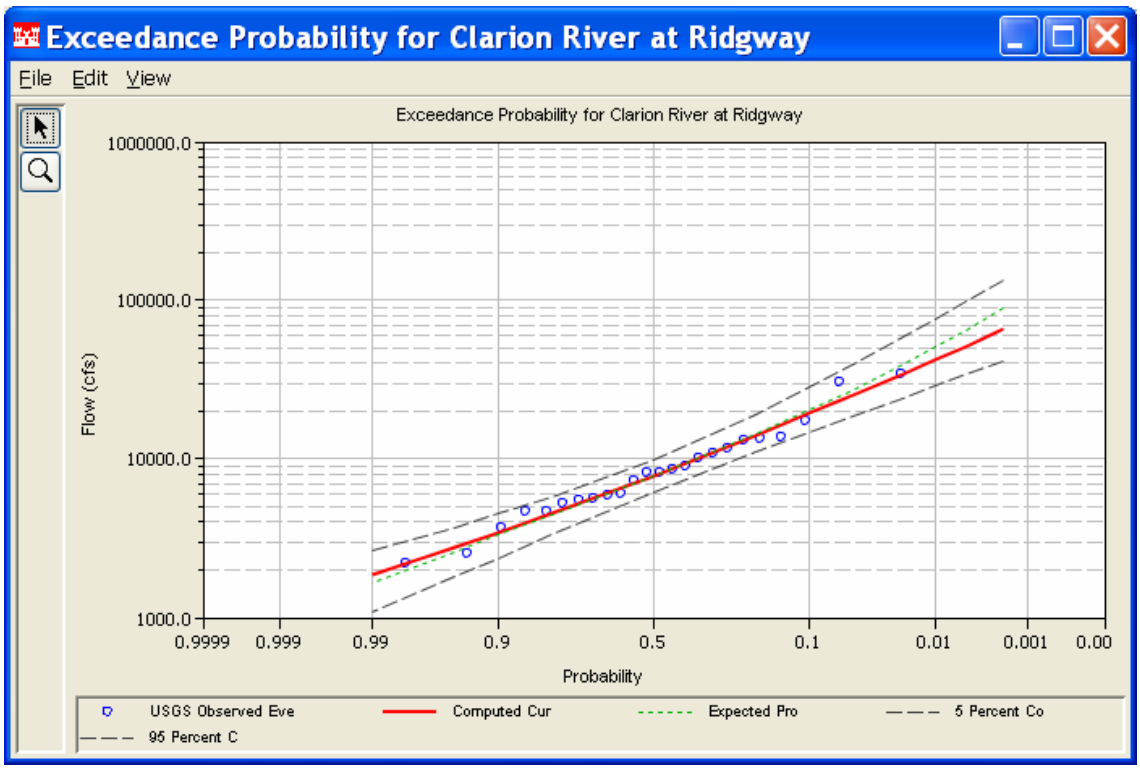
US Army Corps
of Engineers®
Hydrologic Engineering Center

HEC-SSP

Statistical Software Package



User's Manual

Version Beta 1.0
June 2006

Approved for Public Release. Distribution Unlimited. **CPD-86**

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the date needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** January 2006	**3. REPORT TYPE AND DATES COVERED** Computer Program Documentation	
4. TITLE AND SUBTITLE HEC-SSP, Statistical Software Packake			**5. FUNDING NUMBERS**
6. AUTHOR(S) Gary W. Brunner			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER (HEC) 609 Second Street Davis, CA 95616-4687			**8. PERFORMING ORGANIZATION REPORT NUMBER** CPD-86
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Distribution is unlimited.			**12b. DISTRIBUTION CODE**
13. ABSTRACT *(Maximum 200 words)*			
14. SUBJECT TERMS water surface profiles, river hydraulics, steady and unsteady flow, computer program			**15. NUMBER OF PAGES** **16. PRICE CODE**
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	**18. SECURITY CLASSIFICATION OF THIS PAGE** UNCLASSIFIED	**19. SECURITY CLASSIFICATION OF ABSTRACT** UNCLASSIFIED	**20. LIMITATION OF ABSTRACT** UNLIMITED

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Statistical Software Package, HEC-SSP
Software Distribution and Availability Statement

The HEC-SSP executable code and documentation are public domain software that were developed by the Hydrologic Engineering Center for the U.S. Army Corps of Engineers. The software was developed with the United States Federal Government resources, and is therefore in the public domain. This software can be downloaded for free from the HEC internet site (www.hec.usace.army.mil). HEC does not provide technical support for this software to non-Corps users. See our software vendor list (on our web page) to locate organizations that provide the program, documentation, and support services for a fee. However, we will respond to all documented instances of program errors. Documented errors are bugs in the software due to programming mistakes not model problems due to user-entered data.

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Foreword

The U.S. Army Corps of Engineers' Statistical Software Package (HEC-SSP) is software that allows you to perform statistical analyses of hydrologic data.

The first version of HEC-SSP (version 1.0 Beta) was released in June of 2006.

The HEC-SSP software was designed by Mr. Gary W. Brunner, Mr. Jeff Harris, and Dr. Beth Faber. The HEC-SSP User interface was programmed by Mr. Mark Ackerman, and the computational code was programmed by Mr. Paul Ely. This manual was written by Mr. Gary W. Brunner.

CHAPTER 1

Introduction

Welcome to the U.S. Army Corps of Engineers Statistical Software Package (HEC-SSP) developed by the Hydrologic Engineering Center. This software allows you to perform statistical analyses of hydrologic data. The current version of HEC-SSP is limited to performing flood flow frequency analysis based on Bulletin 17B, “Guidelines for Determining Flood Flow Frequency” (1982).

The HEC-SSP software system was developed as a part of the Hydrologic Engineering Center's "Next Generation" (NexGen) of hydrologic engineering software. The NexGen project encompasses several aspects of hydrologic engineering, including: rainfall-runoff analysis; river hydraulics; reservoir system simulation; flood damage analysis; and real-time river forecasting for reservoir operations.

This chapter discusses the general philosophy of HEC-SSP and gives a brief overview of the capabilities of the software system. An overview of this manual is also provided.

Contents

- General Philosophy of the HEC-SSP
- Overview of Program Capabilities
- Overview of This Manual

General Philosophy of the HEC-SSP

HEC-SSP is an integrated system of software, designed for interactive use in a multi-tasking environment. The system is comprised of a graphical user interface (GUI), separate statistical analysis components, data storage and management capabilities, mapping, graphics and reporting facilities.

Over a period of many years, the Hydrologic Engineering Center has supported a variety of statistical packages that perform frequency analysis and other statistical computations. Historically, the programs that received the most use within the Corps of Engineers were HEC-FFA (Flood Frequency Analysis) and STATS (Statistical Analysis of Time Series Data). FFA incorporates Bulletin 17B procedures that have been adopted by the Corps for flow frequency analysis. The STATS software package is used for statistical analysis of time series data. STATS can provide either analytical or graphical frequency analysis, specified by the user. STATS has the capability of computing monthly and annual maximum, minimum and mean values along with flow-duration analysis. Two other packages that used to receive a lot of use within the Corps of Engineers are REGFRQ (Regional Frequency Computation) and MLRP (Multiple Linear Regression Program). REGFRQ performs regional frequency analysis and MLRP is a multiple linear regression analysis tool.

The goal of HEC-SSP is to ultimately combine all of the statistical analyses capabilities of HEC-FFA, STATS, REGFRQ and MLRP. The current version of HEC-SSP supports performing flood flow frequency analyses based on Bulletin 17B Guidelines. New features and additional capabilities will be added in future releases.

Overview of Program Capabilities

HEC-SSP is designed to perform statistical analyses of hydrologic data. The following is a description of the major capabilities of HEC-SSP.

User Interface

The user interacts with HEC-SSP through a graphical user interface (GUI). The main focus in the design of the interface was to make it easy to use the software, while still maintaining a high level of efficiency for the user. The interface provides for the following functions:

- File management

- Data entry, importing, and editing
- Statistical analyses
- Tabulation and graphical displays of results
- Reporting facilities
- On-line help

Statistical Analysis Components

Flow Frequency Analysis (Bulletin 17B) – This component of the software allows the user to perform annual peak flow frequency analyses. The software follows Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," by the Interagency Advisory Committee on Water Data.

Data Storage and Management

Data storage is accomplished through the use of "text" files (ASCII and XML), as well as the HEC Data Storage System (HEC-DSS). User input data are stored in flat files under separate categories of study, analyses, and a data storage list. Annual peak flows are stored in a project HEC-DSS file as time series data. Output data is predominantly stored in HEC-DSS, while a summary of the results is written to an XML file. Additionally, an analysis report file is generated whenever a computation is made. This report file is written to a standard ASCII text file.

Data management is accomplished through the user interface. The modeler is requested to enter a Name and Description for each study being developed. Once the study name is entered, a directory with that name is created, as well as a study file. Additionally a set of subdirectories is created with the following names: Bulletin17bResults; Layouts; and Maps. As the user creates new analyses, an analyses file is created in the main project directory. The interface provides for renaming and deletion of files on a study-by-study basis.

Graphical and Tabular Output

Graphics include a map window and frequency curve plots. The map window can be used to display background map layers. Locations of the data being analyzed can be displayed on top of the map layers. The frequency curve plot shows the results of the 17B analysis, including: the analytically computed curve; the expected probability curve; confidence limits; and the raw data points plotted based on one of three available plotting position methods. Tabular output consists of tables showing the computed frequency curves, confidence limits, and summary statistics. All graphical and tabular output can be displayed on the screen, sent directly to a printer (or plotter), or

passed through the Windows Clipboard to other software, such as a word-processor or spreadsheet.

A report file is available for each Bulletin 17B analysis. This report file includes the input data; preliminary results; all of the statistical tests (Low and High Outliers; Broken Record; Zero Flows Years; Incomplete Record; Regional Skews; and Historic Information); and final results. This report file is similar to the FFA output file.

Overview of This Manual

This user's manual is the primary documentation on how to use HEC-SSP. The manual is organized as follows:

- Chapters 1-2 provide an introduction and overview of HEC-SSP, as well as instructions on how to install the software.
- Chapter 3 provides an overview on how to use the HEC-SSP software in a step-by-step procedure, including a sample problem that the user can follow along with.
- Chapter 4 explains in detail how to enter and edit data.
- Chapter 5 provides detailed discussions on how to perform the Bulletin 17B flow frequency analysis. Additionally, this chapter describes all of the output capabilities available for displaying and printing the results.
- Appendix A contains a list of references.
- Appendix B has a series of example analyses that demonstrate the various capabilities of performing the Bulletin 17B flow frequency analysis.
- Appendix C contains a detailed description or how to customize the graphical plots in HEC-SSP.

CHAPTER 2

Installing HEC-SSP

You install HEC-SSP using the program SETUP.EXE. The Setup program installs the software and the sample applications.

This chapter discusses the hardware and system requirements needed to use HEC-SSP, how to install the software, and how to uninstall the software.

Contents

- Hardware and Software Requirements
- Installation Procedure
- Uninstall Procedure

Hardware and Software Requirements

Before you install the HEC-SSP software, make sure that your computer has at least the minimum required hardware and software. In order to get the maximum performance from the HEC-SSP software, recommended hardware and software is shown in parentheses. This version of HEC-SSP will run on a microcomputer that has the following:

- Intel Based PC or compatible machine with Pentium processor or higher (a Pentium 4 or higher is recommended).
- A hard disk with at least 100 megabytes of free space
- A CD-Rom drive (or CD-R, CD-RW, DVD), if installing from a CD.
- A minimum of 128 megabytes of RAM (256 or more is recommended).
- A mouse.
- Color Video Display (Recommend running in 1024x768 or higher, and as large a monitor as possible). Recommend at least a 17" monitor.
- MS Windows NT 4.0, 2000, or XP (or later versions).

Installation Procedure

Installation of the HEC-SSP software is accomplished through the use of the Setup program.

To install the software onto your hard disk do the following:

1. Insert the HEC-SSP CD into your CD drive (or download the software from our web page: www.hec.usace.army.mil).

2. The setup program should run automatically if installing from a CD. When downloading from the web page you will need to save the setup file in a temporary directory, then execute the "HEC-SSP10_Beta_Setup.exe" file to run the setup program.

3. If the setup program does automatically run from the CD, use the windows explorer to start the HEC-SSP10_Beta_Setup.exe program on the CD.

4. Follow the setup instructions on the screen.

The setup program automatically creates a program group called HEC. This program group will be listed under the Programs menu, which is

under the Start menu. The HEC-SSP program icon will be contained within the HEC program group, within the HEC-SSP subdirectory. The user can request that a shortcut icon for HEC-SSP be created on the desktop. The HEC-SSP executable can be found in the c:\Program Files\HEC\HEC-SSP\1.0 Beta directory with the name "SSP.EXE".

The HEC-SSP user's manual and sample data are also installed with the software. The user's manual can be viewed by going to Start/All Programs/HEC/HEC-SSP then selecting the **User's Manual** sub menu. You must have Adobe Acrobat Reader to view the user's manual. The manual is in the Adobe PDF file format. This viewer can be obtained for free from the Adobe web page.

A zip file containing the sample data sets described in appendix B have been installed in the "**C:\program files\hec\hec-ssp\example data**" directory. It is up to the user to put the sample data into a directory of there choice and to unzip the file. When unzipping the file, make sure that you maintain the directory structure that the data is stored in. The zip file will make a subdirectory within your chosen folder called **FFA Tests**. Additionally there will be other subdirectories made underneath the "FFA Tests" directory. A project file called "FFA Tests.SSP" will be contained in the FFA tests folder. When you run HEC-SSP you can load the test data sets by using the Open Study option from the File menu, and then use the file chooser to select this file.

Uninstall Procedure

The HEC-SSP Setup program automatically registers the software with the Windows operating system. To uninstall the software, do the following:

- From the Start Menu select Control Panel.
- From within the Control Panel folder select Add/Remove Programs.
- From the list of installed software, select the HEC-SSP program and press the Remove button.
- Follow the uninstall directions on the screen and the software will be removed from your hard disk.

CHAPTER 3

Working With HEC-SSP - An Overview

HEC-SSP is an integrated package of statistical analysis modules, in which the user interacts with the system through the use of a Graphical User Interface (GUI). The current version is capable of performing flow frequency analyses based on the Bulletin 17B "Guidelines for Determining Flood Flow Frequency," dated March 1982.

In HEC-SSP terminology, a **Study** is a set of files associated with a particular set of data and statistical analyses being performed. The files for a study are categorized as follows: study information, data list, and analysis data.

This chapter provides an overview of how a flow frequency analyses can be performed with the HEC-SSP software.

Contents

- Starting HEC-SSP
- Overview of the Software Layout
- Steps in Performing a Bulletin 17B Frequency Analysis

Starting HEC-SSP

When you run the HEC-SSP Setup program, a new program group called **HEC** and program icon called **HEC-SSP** are created. They should appear in the start menu under the section called **All Programs**. The user also has the option of creating a shortcut on the desktop. If a shortcut is created, the icon for HEC-SSP will look like the following:

Figure 3-1. The HEC-SSP Icon in Windows.

To Start HEC-SSP from Windows:

- Double-click on the HEC-SSP Icon. If you do not have an HEC-SSP shortcut on the desktop, go to the **Start** menu and select **All Programs**, then select **HEC**, and then **HEC-SSP**.

Overview of the Software Layout

When you first start HEC-SSP, you will see the main window as shown in Figure 3-2, except you will not have any study data on your main window. As shown in Figure 3-2, the main window is laid out with a Menu Bar, a Tool Bar, and four window panes.

The upper right pane (which represents most of the window area) is the **Main View Pane**. This area is used for displaying maps, data editors, and analysis windows.

The upper left pane is called the **Study Pane**. The Study Pane acts like an explorer tree into the study. The top level of the tree is the study (Clarion River in this example). Below the study is an analyses branch, a data branch, and a map branch. Under the analyses branch, the first level is the types of analysis in the current study. Under each analysis type will be the current user-defined analyses for that type. The data branch lists all of the available data sets that have been brought into the current study. Generally a data set represents a piece of data at a specific point location. For example, all of the peak annual flows at a single gage would be stored as a single data set. When an analysis is created, the user selects a data set to be used for that particular analysis. The Map branch of the tree contains any maps the user has put together for the study. By default there is automatically a “Base Map” listed under the maps folder.

The lower left pane, and associated tabs, also belongs to the study pane. This window is used to show additional information about items selected in the study explorer tree. The Tabs are used to switch to different views within the study pane window. The first tab, labeled Study, shows the explorer view of the study. The second tab, labeled Maps, lists the available maps and map layers associated with each map. The last tab, labeled Files, shows all of the files that make up the current study.

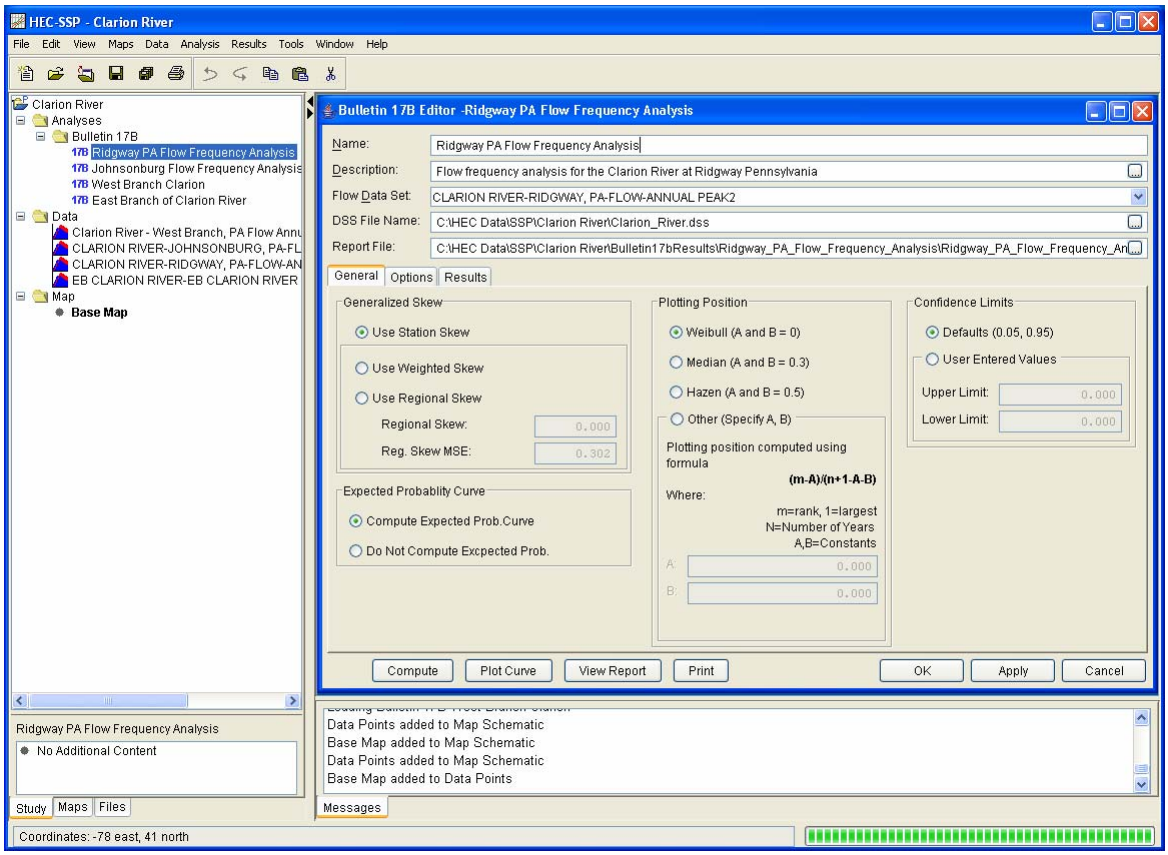
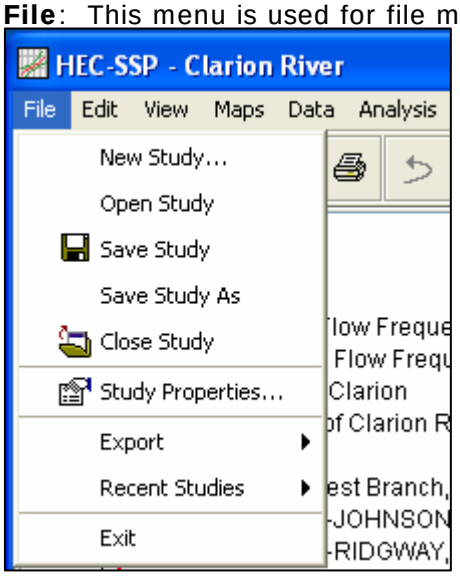


Figure 3-2. The HEC-SSP Main Window.

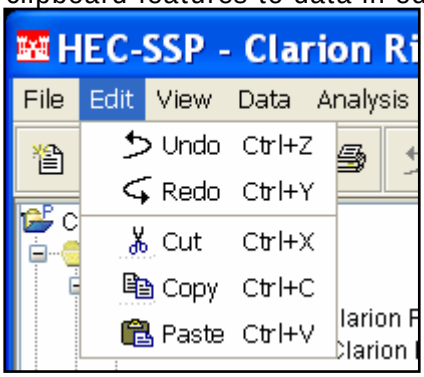
The lower right pane is called the **Message Pane**. This pane is used to display messages from the software as to what it is doing.

At the top of the HEC-SSP main window is a Menu bar with the following options:

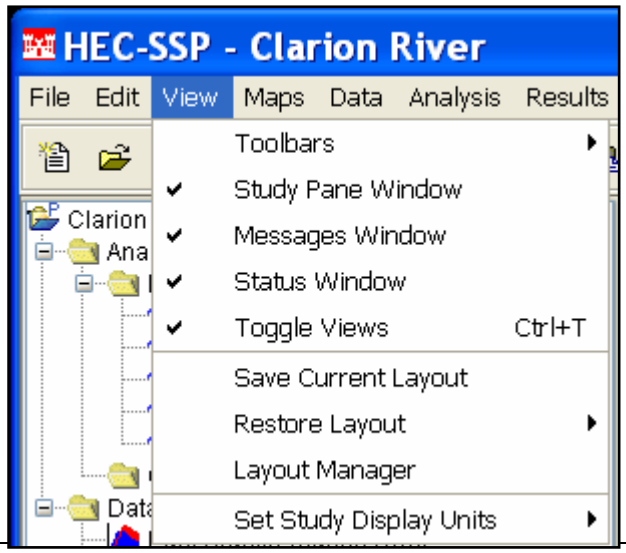
File: This menu is used for file management. Options available under the File menu include: New Study; Open Study; Save Study; Save Study As; Close Study; Study Properties; Export; Recent Studies; and Exit. The Study Properties option is used to describe the study and to set the units to be used. The Export option is used to export HEC-SSP results, stored in the study DSS file, to another DSS file. The Recent Studies option lists the most recently opened studies, which allows the user to quickly open a study that was recently worked on.



Edit: This menu is used for applying the Cut, Copy, and Paste clipboard features to data in editable fields and tables. Additional options are available for Undo and Redo when entering and editing data.

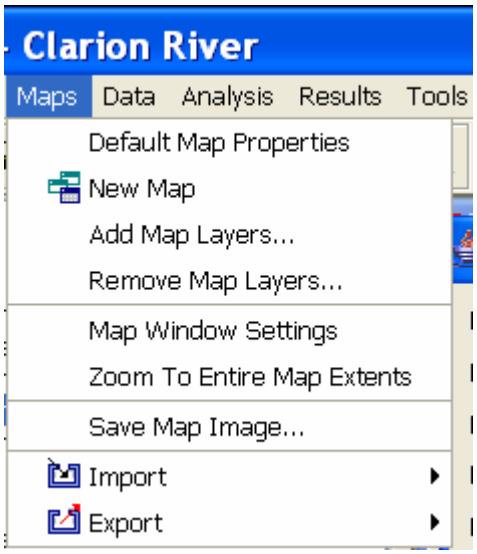


View: The View menu allows the user to control display of the toolbars, the Study Pane, Message Pane, and the status window. The user can also toggle between viewing all of the panes or just the Main View Pane. The View menu also has options for saving the current layout (currently opened windows and their sizes and locations); and restoring a previous saved layout. The final option on the View menu is to set the study display units. This option allows the

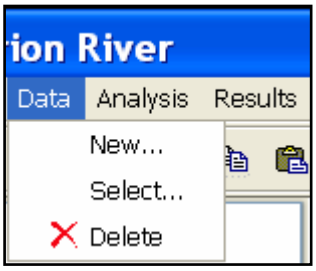


user to switch viewing output between English and metric units.

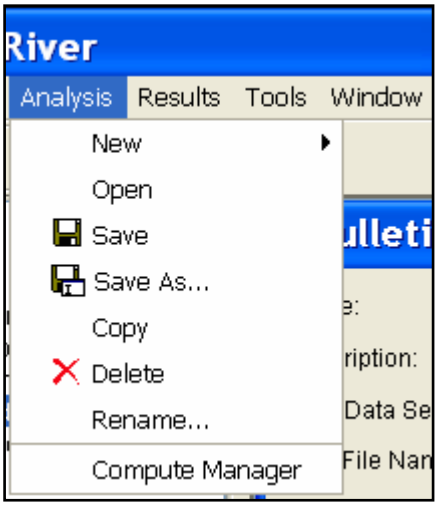
Maps: This menu is used to set the Default Map Properties (Coordinate system, extents, etc…), define a new map, add map layers to the study, and remove a map. Additionally, this menu has the following options available: Map window settings (allows the user to turn map layers on and off); Zoom To Entire Map Extents; Save Map Image; Import; and Export. The Zoom To Entire Map Extents option displays the entire set of map layers within the map window. The Save Map Image can be used to save the current view of the map to a file. The import and export options currently support importing and exporting a stream alignment to the map window. Later versions of the software will have additional import and export options.



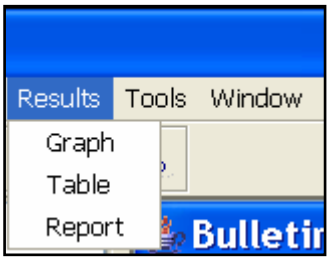
Data: This menu allows the user to define a new data set (name the data set and open the data editor), open an existing data set with the data editor, and delete any existing data sets from the data store list.



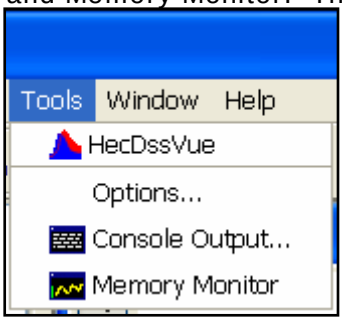
Analysis: This menu is used to create the various statistical analyses available in the software. Each statistical analysis is saved as a separate file, containing the information that is pertinent to that specific analysis type. The current options under this menu item include: New; Open; Save; Save As; Copy; Delete; Rename; and Compute Manager. The compute manager allows the user to select one, several, or all of the analyses, and then have then all recomputed.



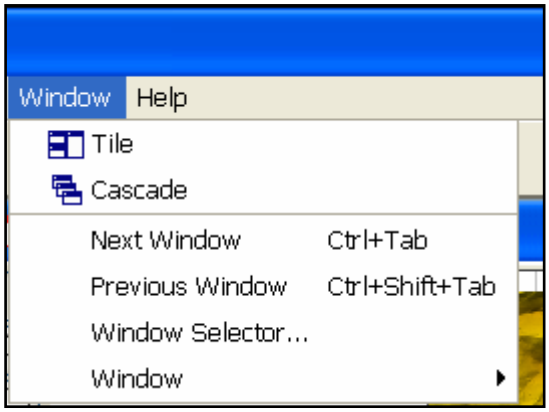
Results: This menu allows the user to graph and tabulate any of the existing analyses that have been performed. Additionally, the user can request to view the report file from a previously computed analysis. Users must select at least one analysis from the Study Pane window, and then select either Graph, Table, or Report. If more than one analysis of the same type are selected (this is accomplished by holding down the control key while left clicking on the various analyses), the Graph option will plot the results from all that are selected on the same plot. However, when multiple analyses are selected, the Table and Report option bring up separate windows for each of the selected analyses.



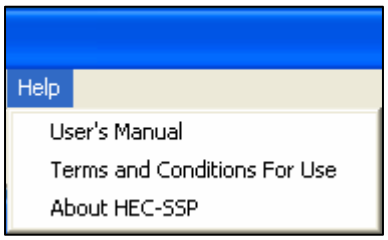
Tools: This menu includes: Hec-DssVue; Options; Console Output; and Memory Monitor. The Hec-DssVue option brings up the Hec-DssVue program and automatically loads the current study DSS file. Hec-DssVue is a DSS utility to tabulate, graph, edit, and enter data into DSS. The Options menu item brings up an options window that allows the user to set default HEC-SSP options.



Window: This menu includes: Tile; Cascade; Next Window; Previous Window; Window Selector; and Window. All these options are used to control the appearance of the windows in the Main View Pane area of the software. When more than one window is open (such as a data editor, and various analysis windows), these menu items will help the user organize the windows, or quickly navigate to a specific window. The Tile option can be used to organize all of the currently opened windows in either a vertical or horizontal tile. The Cascade option puts one window on top of the next in a cascading fashion. The Next Window option brings the next window in the list of currently opened windows to the top. The Previous Window brings the last window that was on top back to the top. The Window Selector option brings up a pick list of the currently opened windows and allows you to select the one you want. The Window option has a sub menu list of all the opened windows and allows you to select one like a menu option.



Help: This menu allows the user open up the HEC-SSP User's manual, read the terms and conditions of use statement, and display the current version information about HEC-SSP.



Also on the HEC-SSP main window is a Tool Bar. The buttons on the tool bar provides quick access to the most frequently used options under the HEC-SSP File and Edit menus.

Steps in Performing a Bulletin 17B Frequency Analysis

There are five main steps in performing a flow frequency analysis with HEC-SSP:

- Starting a new project
- Adding a Background Map (Optional)
- Importing, Entering, and Editing Data
- Performing the Bulletin 17B Frequency Analysis
- Viewing and Printing Results

Starting a New Project

The first step in performing a Flow Frequency analysis with HEC-SSP is to establish which directory you wish to work in and to enter a title for the new study. To start a new study, go to the **File** menu on the main HEC-SSP window and select **New Study**. This will bring up a New Study window as shown below.

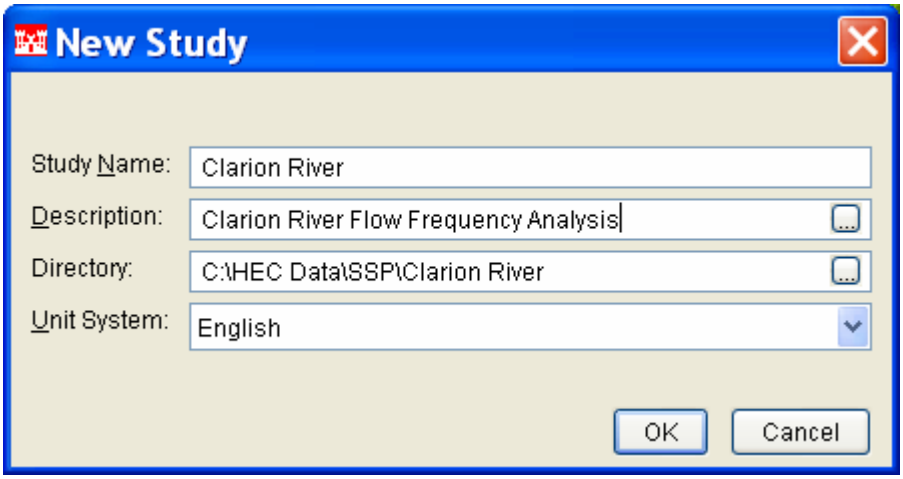


Figure 3-3. New Project Window

As shown in Figure 3-3, the user is required to enter a name for the study; select a directory to work in (a default location is provided); and select the desired units system to work in. Adding a description of the study is optional. Once you have entered all the information, press the **OK** button to have the information accepted. After the **OK** button is pressed, a subdirectory will be created under the user chosen directory. The subdirectory will be labeled the same name as the user-entered study name. This study directory is where the project file, as well as other study files and directories will be located. Additionally, a default map window will appear in the Main View Pane. However, the map window will be blank when it first comes up.

Adding a Background Map

By default, when you start a new project in HEC-SSP a default map window (called Base Map) will open in the Main View window pane. Having a background map is optional in HEC-SSP. Not having a map does not prevent the user from importing and entering data, or performing an analysis and viewing results. The map is mostly a visual aid of the study area. Additionally, when you bring in gage data you can enter the map coordinates of the gage and it will show up on the map. Once a gage is located on the map you can right click on it and get a pop up menu for editing the data, or graphing and tabulating the results.

To add a map layer to the default map, go to the **Maps** menu and select **Add Map Layers**. When this option is selected a file chooser window will appear (Figure 3-4) allowing the user to select map layers to bring into the map. The **Create Copy** option on the window will make a copy of the selected map and place it in the Maps subdirectory of the study.

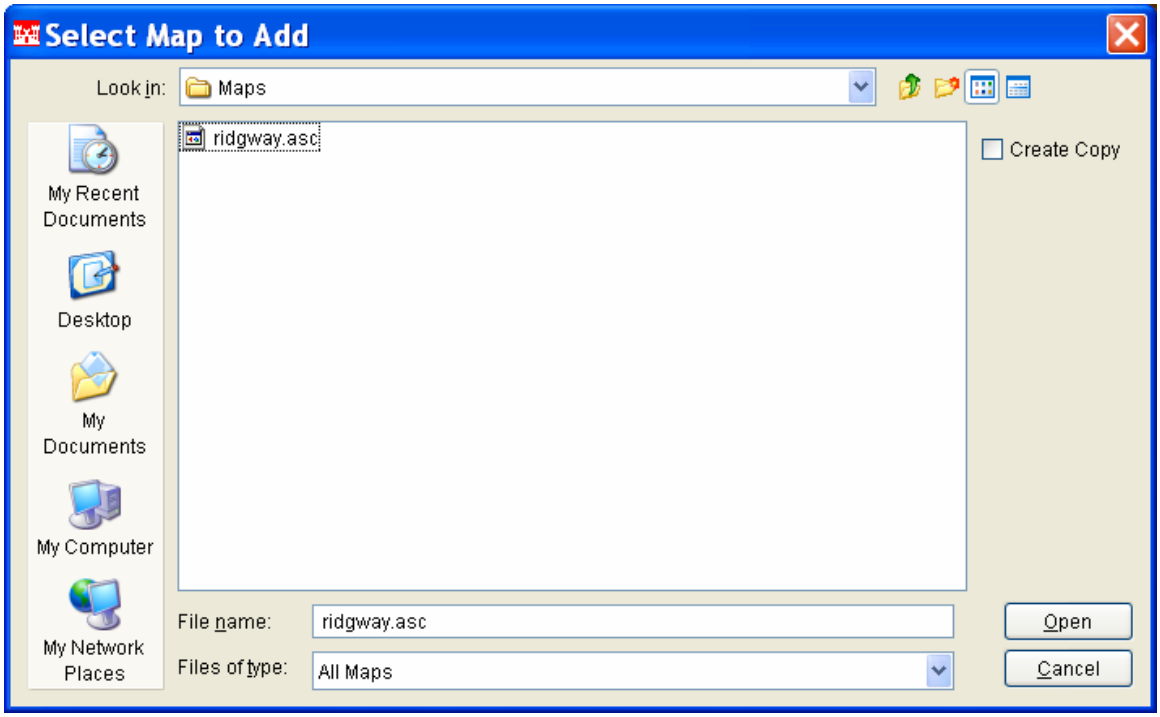


Figure 3-4. Add Map Layers File Chooser.

Currently the HEC-SSP software can have the following types of map layers: USGS DLG; AutoCAD DXF; Arc shapefile; Raster Image; USGS DEM; Arc Info DEM; and ASCII NetTIN.

An example map is shown in Figure 3-5. This map is an Arc Info DEM that was exported in the ASCII file format.

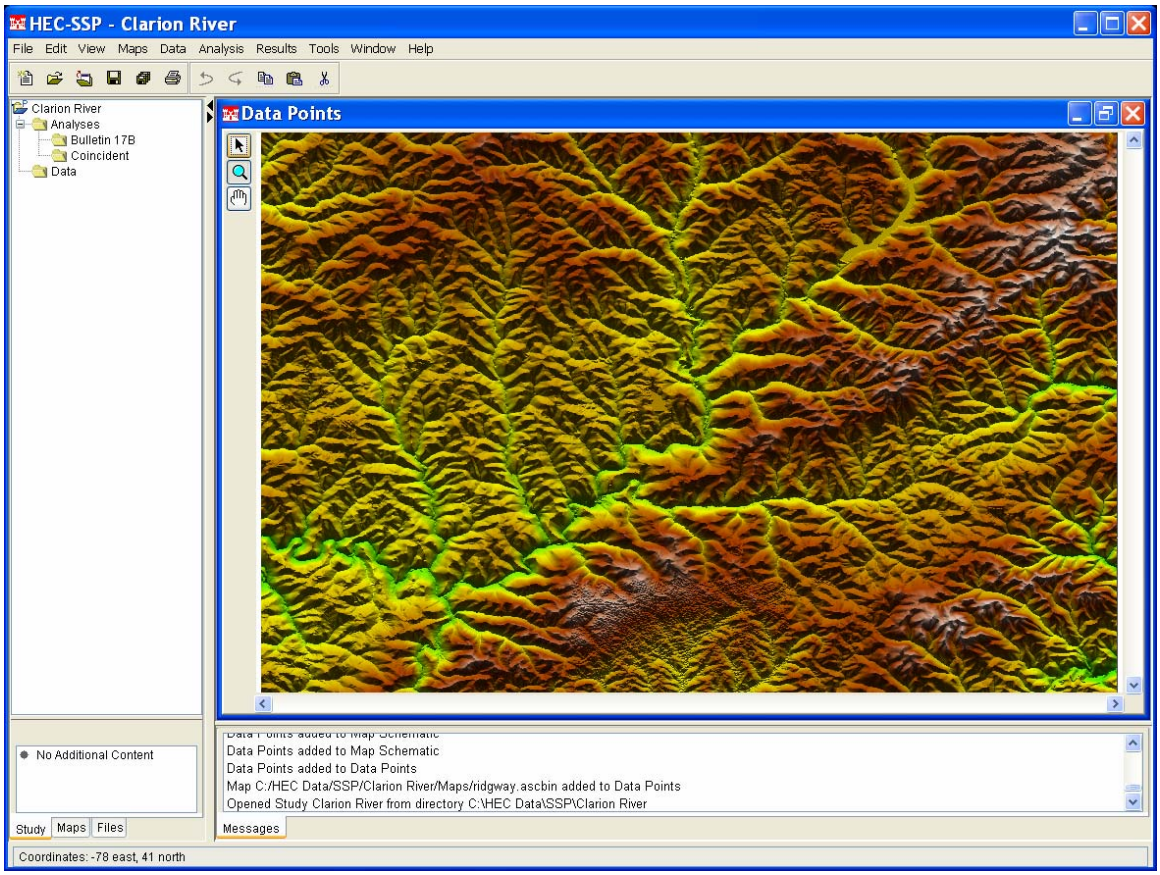


Figure 3-5. Example Background Map.

If more than one map layer is going to be used to make up a map, then it is up to the user to ensure that all map layers are in the same coordinate system. HEC-SSP does not perform coordinate system projections, it will only display map layers that are in a consistent coordinate system. Also, HEC-SSP can not always determine the coordinate system for all map layers entered. However, under the **Maps** menu item is an option called **Default Map Properties**. This menu option can be used to set the default coordinate system for the map layers displayed in HEC-SSP. The user should set the default coordinate system first, then begin to bring in map layers to the study.

Importing, Entering, and Editing Data

Before any analyses can be performed, the user must bring data into the HEC-SSP study. For a peak flow frequency analysis following Bulletin 17B, the data consists of peak annual flow data at gaged locations. To bring data into HEC-SSP go to the **Data** menu and select **New**. This will bring up the data editor as shown in Figure 3-6.

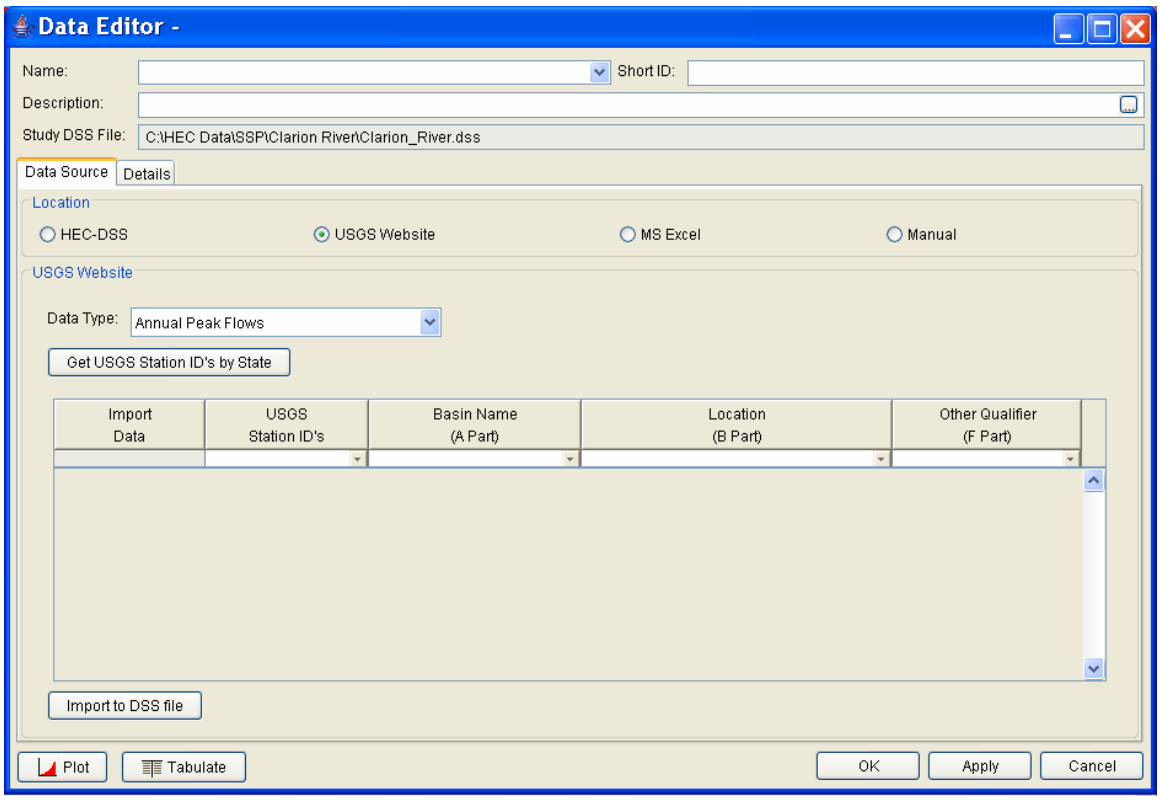


Figure 3-6. HEC-SSP Data Editor

As shown in Figure 3-6, the Data Editor has fields for the Name, Short Identifier, and the Description of the data at the top of the window. Additionally it lists the default DSS file name that the data will be stored in once it is brought into the study. The default DSS file is always labeled the same name as your study with the .DSS file extension.

The Data Editor contains two tabs, **Data Source** and **Details**. The **Data Source** tab is shown first. This tab is used for selecting and defining a source for bringing data into the HEC-SSP study. Currently, there are four ways to bring data into an HEC-SSP study: import from another HEC-DSS file; Import data from the USGS web site; import from a Microsoft Excel spreadsheet; and manually entering the data into a table. All of these methods will import data into the study DSS file.

For this example, only importing data from the USGS website will be shown. For a complete description of the data editor see chapter 4, "Using the Data Editor," in this manual. To import data from the USGS website, first select the **USGS Website** option from the list of four options available in the Location panel. Next, select the data type. Currently only **Annual Peak Flows** is available. Future versions of HEC-SSP will have other data types as more functionality is added to the software. The next step is to press the button labeled **Get USGS Station ID's by State**. When this button is pressed a popup window

will appear (Figure 3-7) allowing the user to select a state from which to get data.

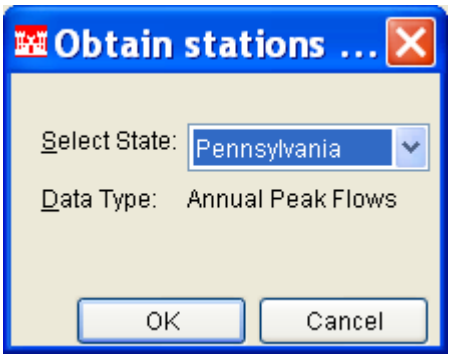


Figure 3-7. Window to Select a State for Downloading Data

Once a state is selected, press the **OK** button and a list of the available gages from that state will appear in a pick list as shown in Figure 3-8. Check the boxes for all of the gages you would like to import then press the **Import to DSS File** button. Once the import button is pressed, a process will begin in which the data will be downloaded from the USGS website and saved in the study DSS file. The USGS import process will download annual peak flow data, annual peak stage data, and the USGS data quality codes. Therefore, for each gage location you request, three DSS records will be written to the study DSS file.

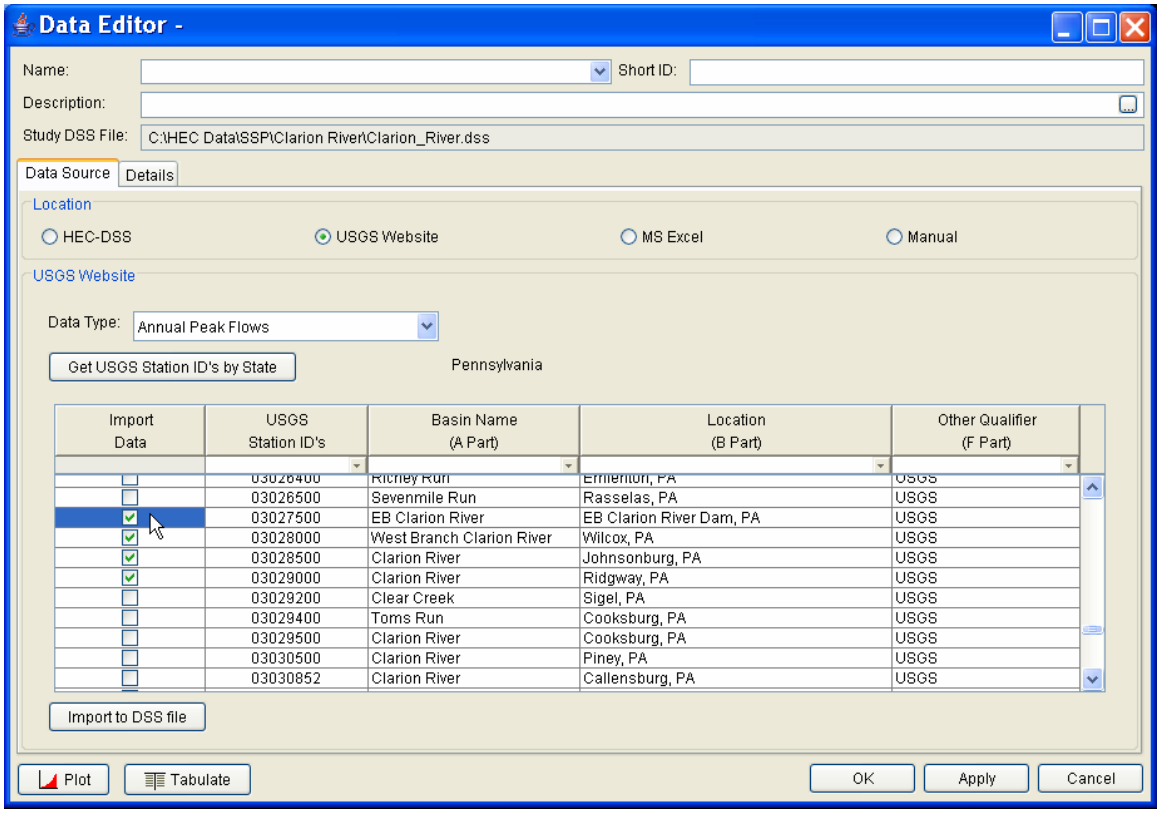


Figure 3-8. Example of choosing gages from a USGS state list to import

In addition to the data itself, any metadata that is available will be downloaded and stored with the data. The metadata can be viewed from the **Details** Tab on the Data Editor. An example of metadata on the Details tab is shown in Figure 3-9.

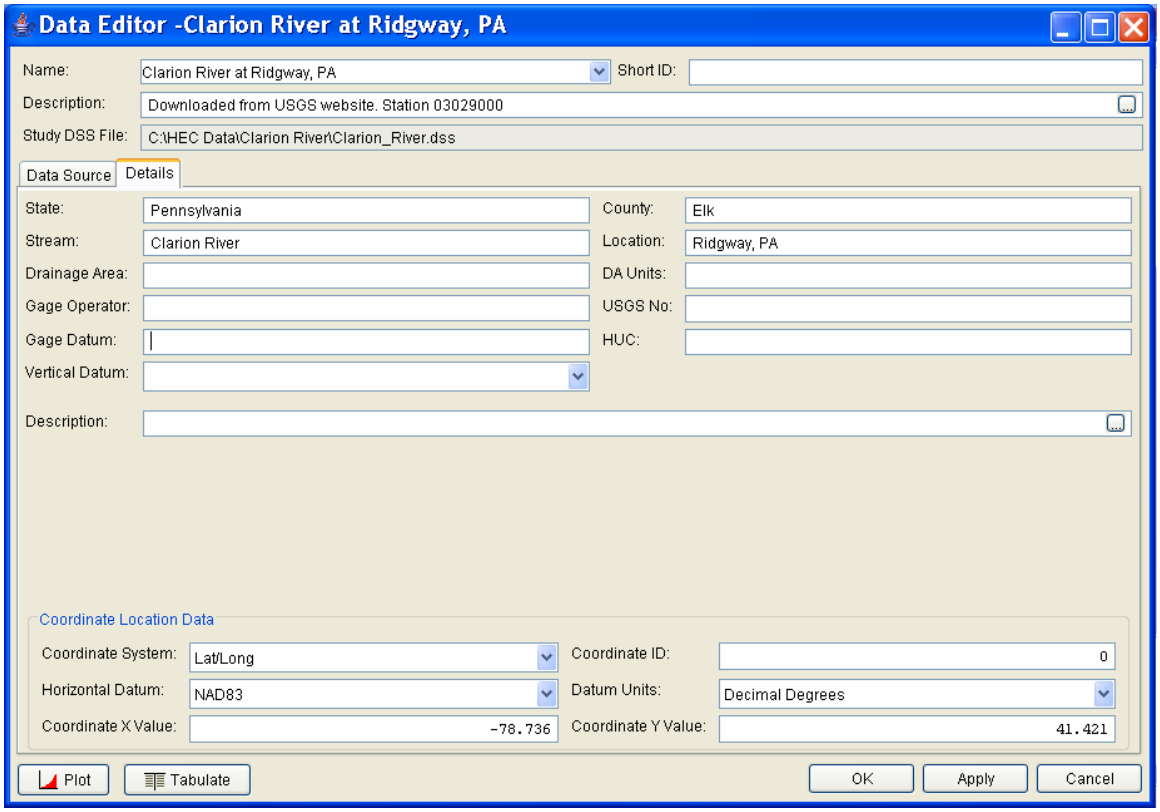


Figure 3-9. Example metadata on the Details Tab

As shown in Figure 3-9, the metadata consists of the: State; County; Stream; Location; Drainage Area; DA Units; Gage Operator; USGS Gage No.; Gage Datum; HUC (Hydrologic Unit Code); Vertical Datum; and a description field. Additionally, the coordinate location of the data is shown. The coordinate location data consists of: Coordinate System; Coordinate ID; Horizontal Datum; Datum Units; Coordinate X Value; and Coordinate Y Value. Most of the USGS data is retrieved in the Latitude/Longitude coordinate system as shown in the example.

If the metadata does not download automatically, the user has the option to enter any of the information by hand. Metadata is not generated automatically for any of the other three data sources. Therefore, entering the metadata is required if the user wants the data to be carried along with the study.

After the data is imported into the study, the user can select any one of the gages from the drop down list located in the **Name** field at the top of the Data Editor. The user has the option to change the name of the data, enter a short identifier, and put in a longer description of the data. Additionally, at the bottom of the data editor is a Plot and Tabulate button. If you press the **Plot** button you will get a plot of the peak flow data for that gage location. If you press the **Tabulate** button you will get a table containing the data.

Once you are satisfied with the data and metadata that have been imported, press the **OK** button to close the Data Editor and save the data. The **Apply** button is used to accept the data for use in the computations, without closing the editor. The **Cancel** button will close the editor and not apply anything that was done while in the data editor.

If the data has coordinate location information, it will then be plotted on top of the background maps. The software will convert the coordinates of the point data to the default coordinate system of the base map. The user can interact with the plotted points by right clicking on the gage icon and a pop-up menu will appear as shown to the left. The user has the option to edit the data, plot the data, tabulate it, rename the label, or delete the data.

Performing the Bulletin 17B Flow Frequency Analysis

To perform a flow frequency analysis, go to the **Analysis** menu and select **New > Bulletin 17B Flow Frequency**. This will bring up a blank Bulletin 17B Analysis Editor as shown in Figure 3-10.

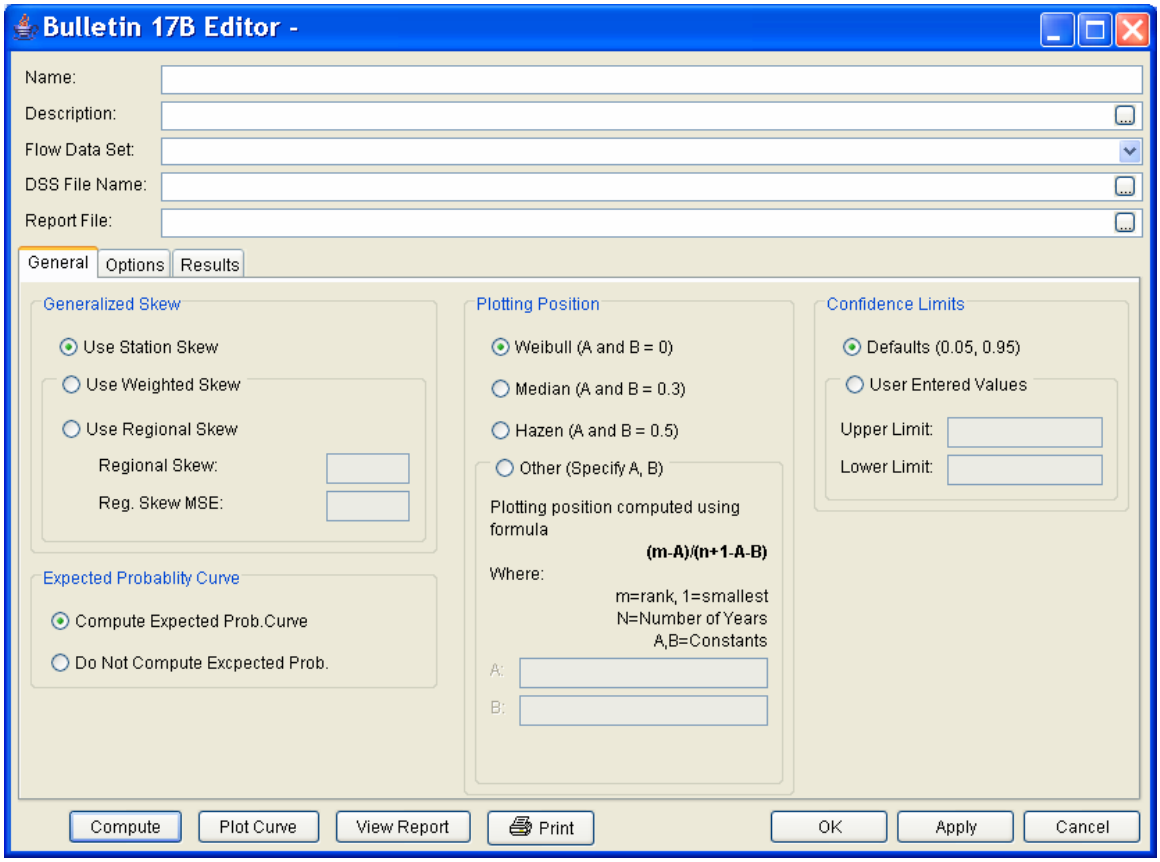


Figure 3-10. Bulletin 17B Flow Frequency Analysis Editor

As shown in Figure 3-, the user must enter a name for the analysis; a description (optional); select a flow data set (gage data stored in project DSS file); enter or select a name for the output DSS file; and enter or select a name for the report file.

The analysis window contains three tabs: General; Options; and Results. The **General** tab contains settings for: Generalized Skew; Expected Probability Curve; Plotting Positions; and Confidence limits. Default settings are already established for each of the options on the General tab. However, the user can change any of the default settings.

The **Options** tab contains information on: Low Outlier Threshold; Historic Period Data; and User-Specified Frequency Ordinates. These options are not required for most analyses, but may be necessary depending upon the data.

A detailed description of each of the Bulletin 17B settings and options can be found in chapter 5, "Performing a Bulletin 17B Flow Frequency Analysis." For this example default settings will be used.

Once all of the settings and options have been selected, the user presses the **Compute** button to have the computations performed. When the computations have finished a message window will pop up saying "Computations Complete." Press the **OK** button on the message window to have it disappear. Once the computations have finished the user can begin to look at output.

Viewing and Printing Results

Tabular output can be found by selecting the **Results Tab** on the Analysis Editor. When this tab is pressed, a set of tables will appear as shown in Figure 3-11:

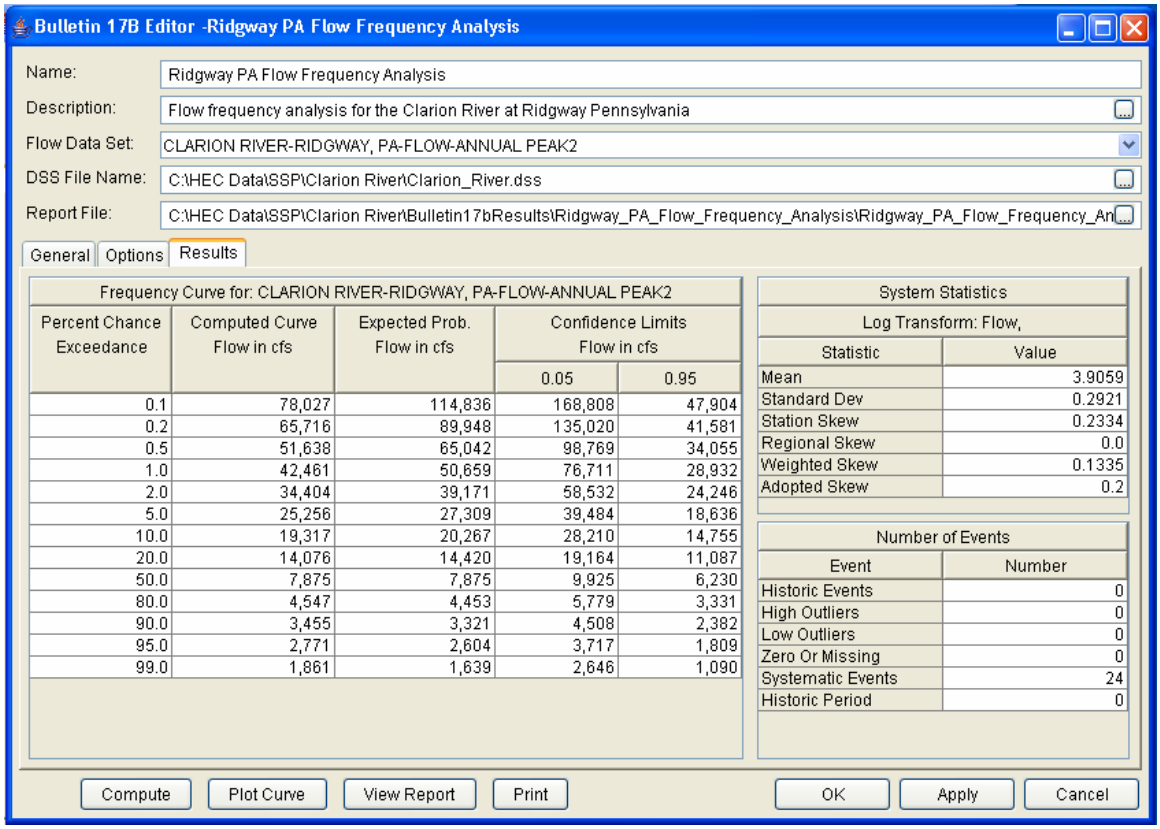


Figure 3-11. Tabular Results of 17B Flow Frequency Analysis

The primary table on the **Results** tab consists of: Percent Chance Exceedance; Computed flow frequency curve; the Expected Probability adjusted curve; and the 5 and 95 percent Confidence Limits. The second table (top right) contains the general statistics about the data, such as: mean; standard deviation; station skew; regional skew; weighted skew; and the adopted skew of the analysis. The third table (lower right) contains the number of: historic events; high outliers; low outliers; zero or missing values; systematic events in the data set; and the number of years in the historic period. The table can be printed by pressing the **Print** button at the bottom of the Analysis window.

Graphical output can be obtained by pressing the **Plot Curve** button at the bottom of the Analysis editor. When this button is pressed, a plot will appear like the one in Figure 3-12.

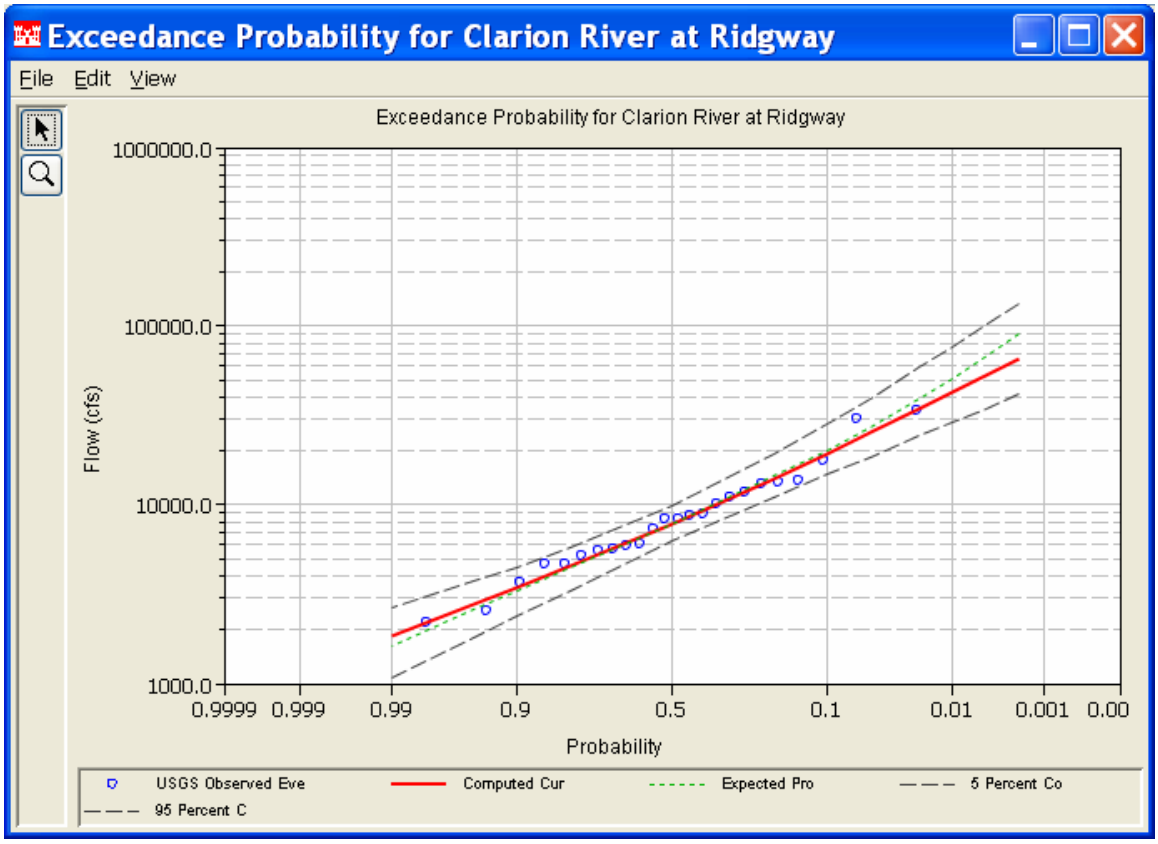


Figure 3-12. Example Flow Frequency Curve Plot

As shown in Figure 3-12, the plot contains the computed frequency curve, the expected probability adjusted curve, the confidence limits; and the data points plotted by the user-selected plotting position method. Additionally, a plot caption is listed at the top. The plot caption is by default the user defined name of the Analysis. The plot can be printed or sent to the windows clipboard by using the **Print** and **Copy to Clipboard** options found under the Plot windows **File** menu.

The final piece of output available from a flow frequency analysis is a text report file. The report file lists all of the input data and user settings; plotting positions of the data points; intermediate results; each of the various statistical tests performed (i.e. high and low outliers, historical data, etc…); and the final results. This file is often useful for understanding how the software arrived at the final frequency curve. To view the Report file press the **View Report** button at the bottom of the Analysis window. When this button is pressed a window will appear containing the text report as shown in Figure 3-13.

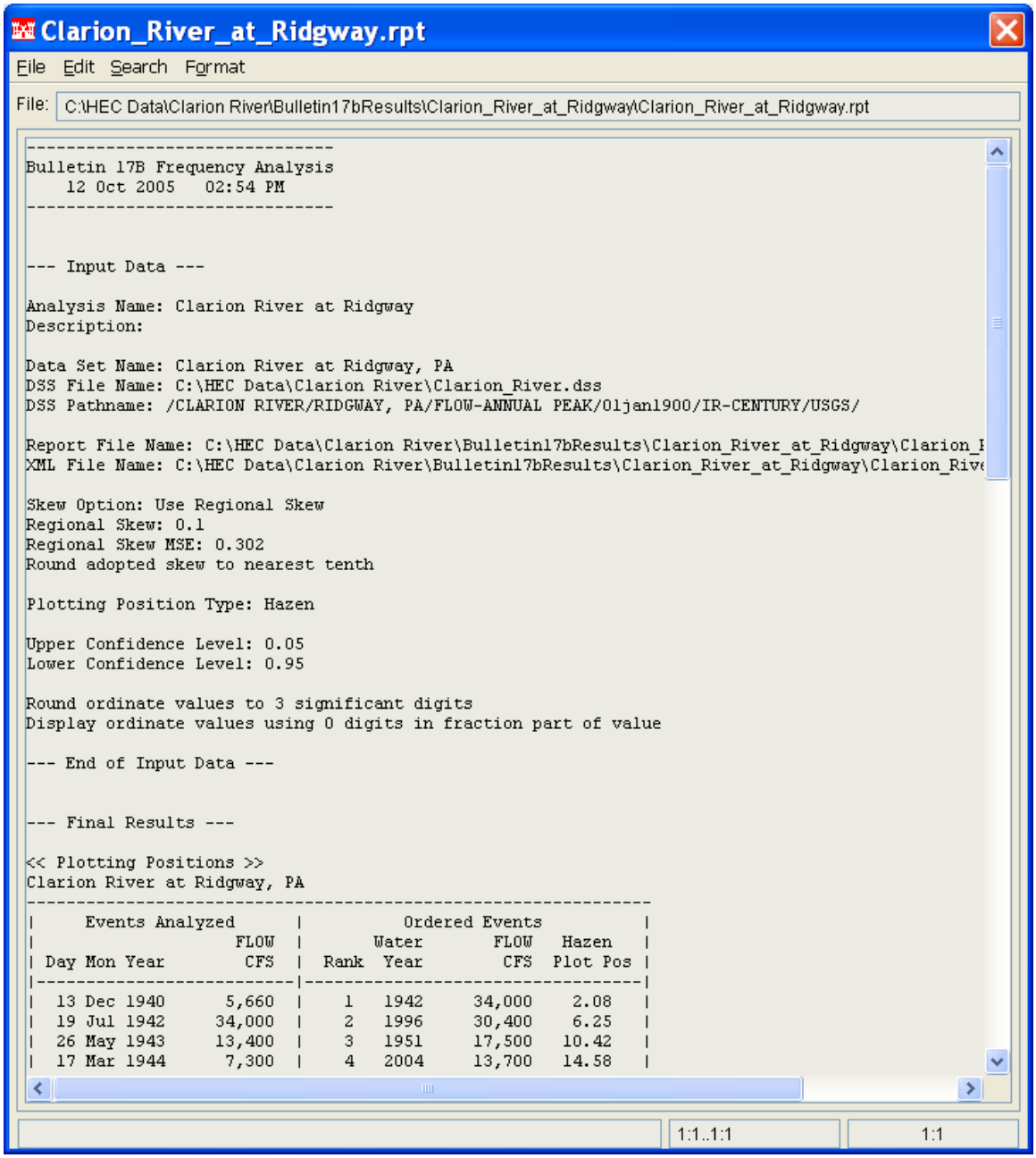


Figure 3-13. Example Report File From Bulletin 17B Frequency Analysis.

CHAPTER 4

Using the HEC-SSP Data Editor

The HEC-SSP Data Editor is used to import, enter, and edit data and the corresponding metadata used in an HEC-SSP study. The current version of HEC-SSP is limited to annual peak flow frequency analysis. Therefore, the data editor only supports importing, entering, and editing of annual peak flow data. Future versions of HEC-SSP will allow for other data types as other analyses are made available in the software.

Contents

- Developing a New Data Set
- Importing Data from an HEC-DSS File
- Importing Data from the USGS Website
- Importing Data from an Excel Spreadsheet
- Entering Data Manually
- Meta Data
- Plotting and Tabulating Data

Developing a New Data Set

Before any analyses can be performed in HEC-SSP, the user must import or enter data into the study. Importing, entering, and editing data is accomplished in the Data Editor. To open the data editor go to the **Data** menu and select **New** from the list of options. This will bring up the editor as shown in Figure 4-1.

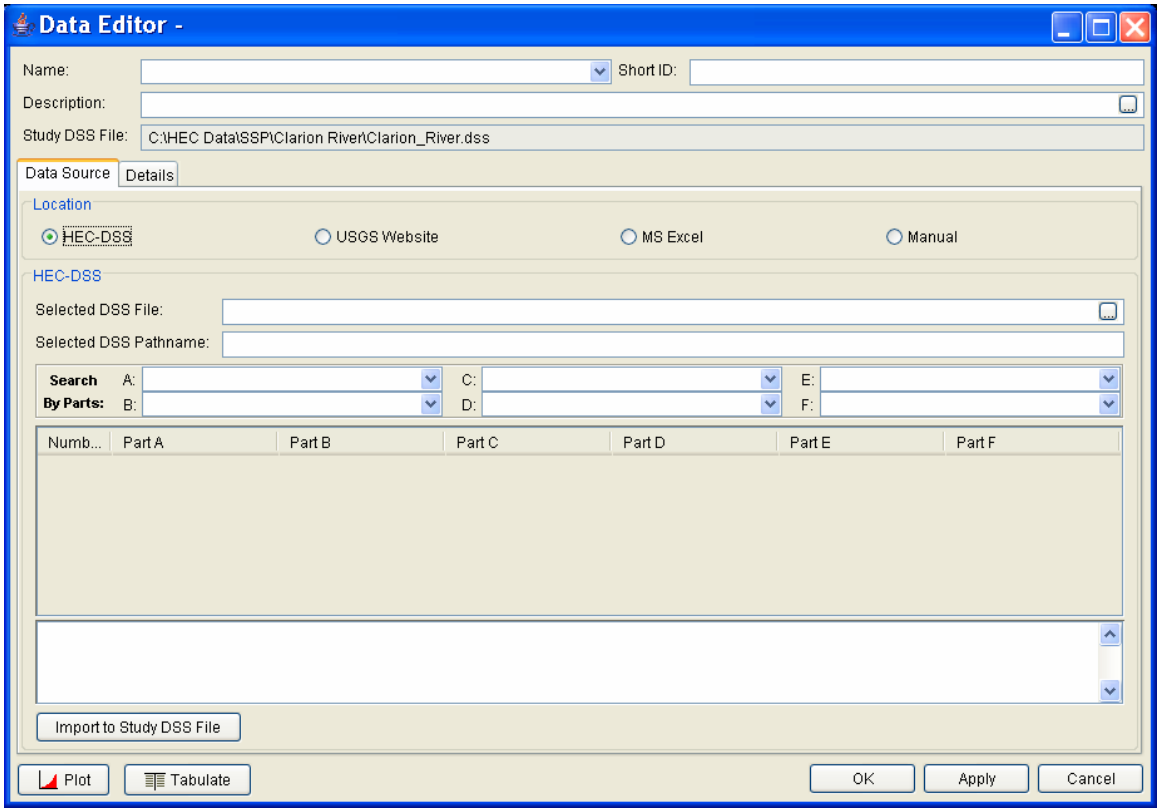


Figure 4-1. HEC-SSP Data Editor

As shown in Figure 4-1, at the top of the editor, the user must enter a Name for the new data set. Optionally, the user can also enter a short identifier (limited to 16 characters), and a description of the data set. A default DSS file name is provided. The DSS file is used for storing the data for the study. The default name is based on the study name plus the extension ".DSS".

The Data editor contains two main tabs - **Data Source**, and **Details**. The **Data Source** tab is used for importing or entering data manually, while the **Details** tab is used to describe the data (i.e. Meta data). The **Data Source** tab contains four options for getting data into the study DSS file: Importing from an existing HEC-DSS file; importing from the USGS Website; importing from an Excel spreadsheet; and entering the data manually.

Importing Data from an HEC-DSS File

To import data from a DSS file into the HEC-SSP study DSS file, first select the **HEC-DSS** radio button on the data editor. Selecting **HEC-DSS** will change the view of the Data Editor to look like the following:

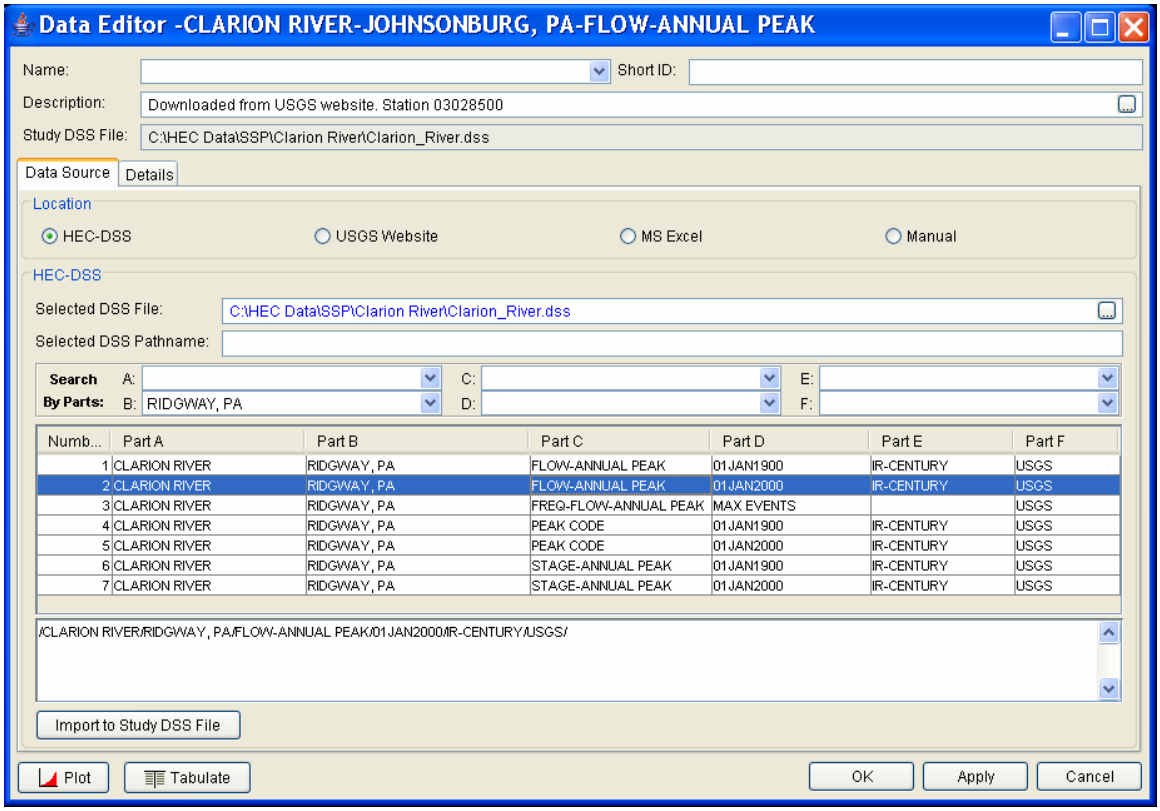


Figure 4-2. Data Editor with HEC-DSS Import Option

As shown in Figure 4-2, the user first selects a DSS file to import from by typing the path and name or by choosing the file browser at the end of the field. Once a DSS file is selected, the table of pathnames will be filled with the records that are contained in that DSS file. The user can reduce the number of listed pathnames by selecting pathname parts to filter in the pathname part selection area just above the table. Any pathname part can be used to filter the list down to a more manageable number of pathnames to select from. The user can then select pathnames to import by double clicking on one or more of the listed pathnames in the table. Each selected pathname will show up in the list below the table. Once the user has selected all of the pathnames that they want to import, pressing the **Import to Study DSS File** button enacts the import process. An HEC-SSP data set will be developed for each pathname that was selected.

Importing Data from the USGS Website

The second way to import data into HEC-SSP is to use the **USGS Website** option. When this option is selected, the data editor will look like the following:

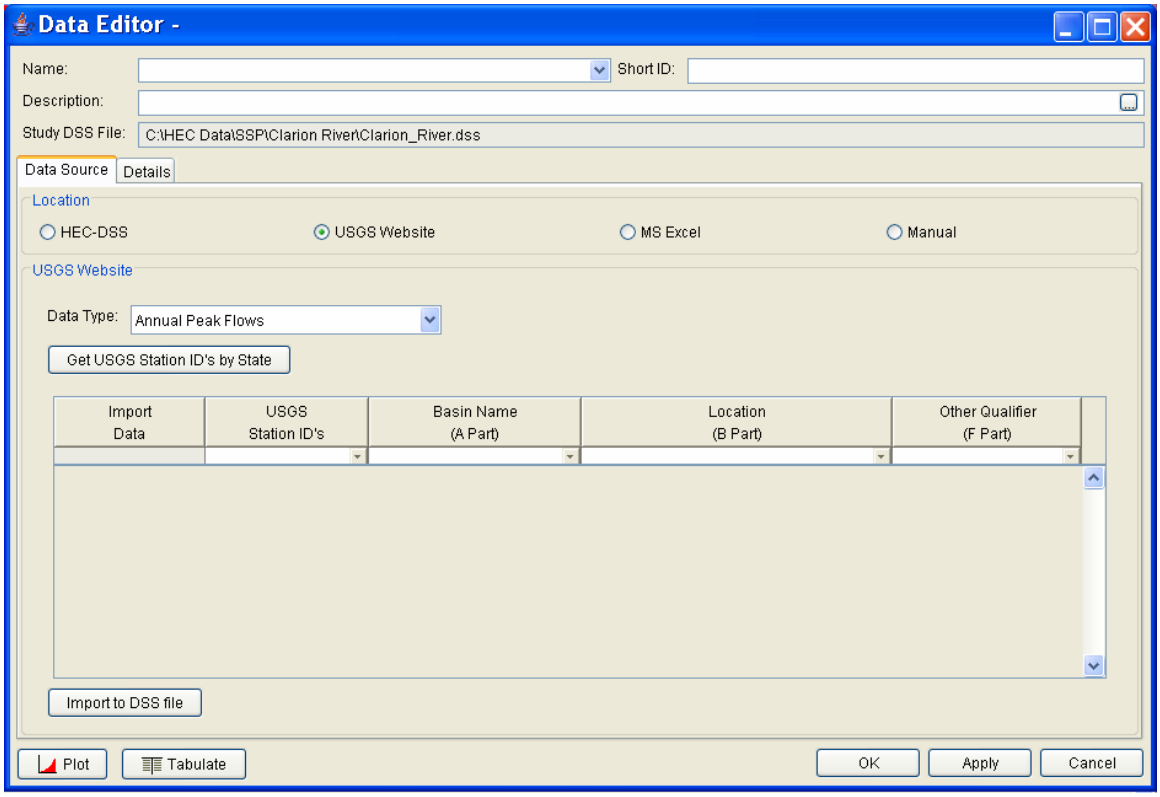


Figure 4-3. HEC-SSP Data Editor with USGS Website Import Option

The first step in using the USGS import option is to select a data type to import (currently you can only select Annual Peak Flows). Next the user should select the **Get USGS Station ID's by State** button. Selecting this button will bring up a small window that allows the user to select a state in which to acquire data. The state selection window is shown in Figure 4-4.

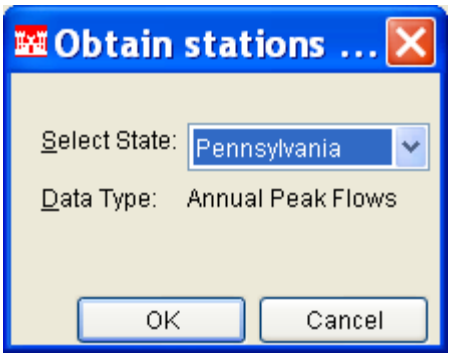


Figure 4-4. Window to Select a State for Importing USGS Data

Once the user selects a state and presses the **OK** button, a process will begin in which all of the gage locations for that state will be downloaded from the USGS website. A listing of all the gages for that state will then show up in the table at the bottom of the data editor. An example of the data editor with a list of USGS gages is shown below.

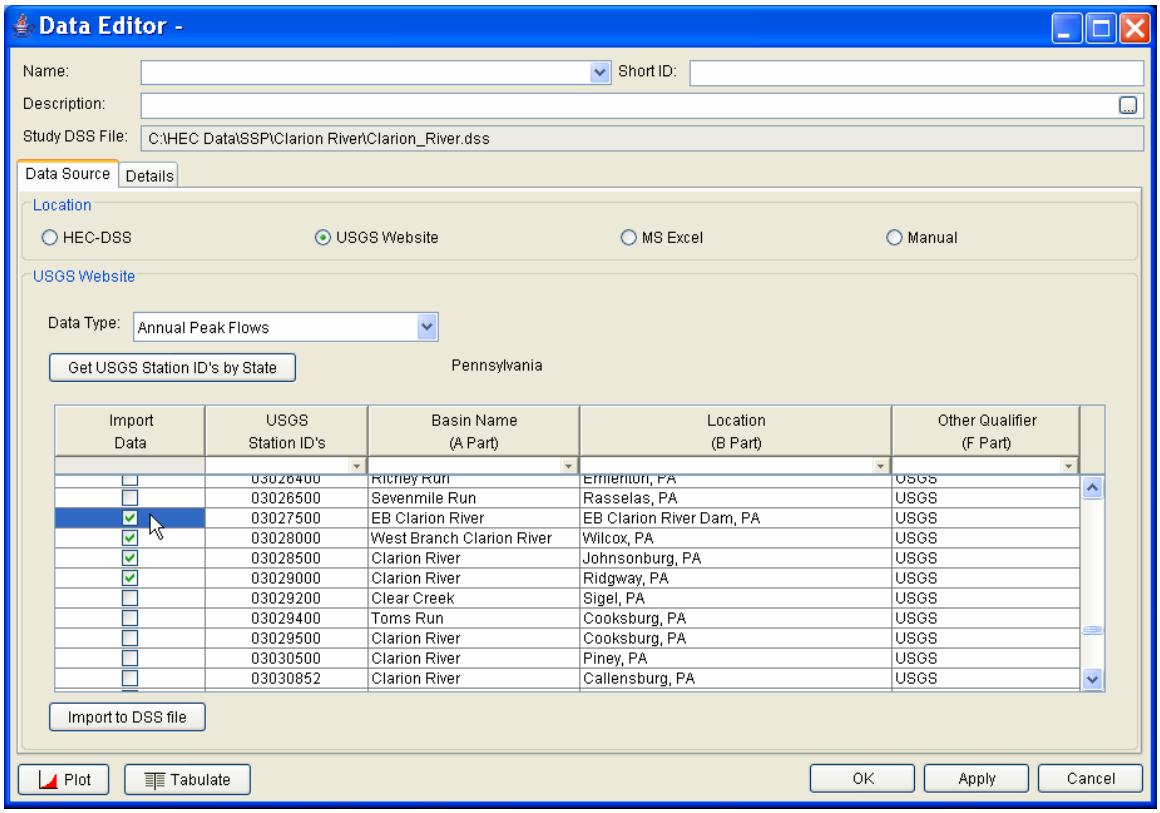


Figure 4-5. Data Editor with USGS Gages Listed in Table

The next step is to select the desired gages for importing into the HEC-SSP study. The user can filter the list to a smaller number of gages by using the filter drop down boxes at the top of the table. To select a gage for importing, simply check the box in the left hand column for each gage location that is to be imported. After all of the desired

locations are selected, press the **Import to DSS File** button to import the data into the study DSS file. Pressing this button will start a process of downloading data from the USGS website. For each selected location, the software will download whatever data is available. Generally the software will download Peak Annual Flows, Peak Annual Stages, and Data Quality Codes for each location. Therefore, three records will be written to the study HEC-DSS file for each gage location. The data quality codes can be viewed from HEC-DSSVue, which is available from the tools menu. For an explanation of the codes, please visit the USGS website.

Warning: all data download from the USGS website should be reviewed to ensure it is appropriate for a Bulletin 17B Flood Flow Frequency Analysis. Some peak flows stored on the USGS website are estimated not measured. The user should be aware of the quality of all the data before using it.

Importing Data from an Excel Spreadsheet

The third option for importing data into HEC-SSP is **MS Excel**. When this option is selected, the data editor will change to the view shown in Figure 4-6.

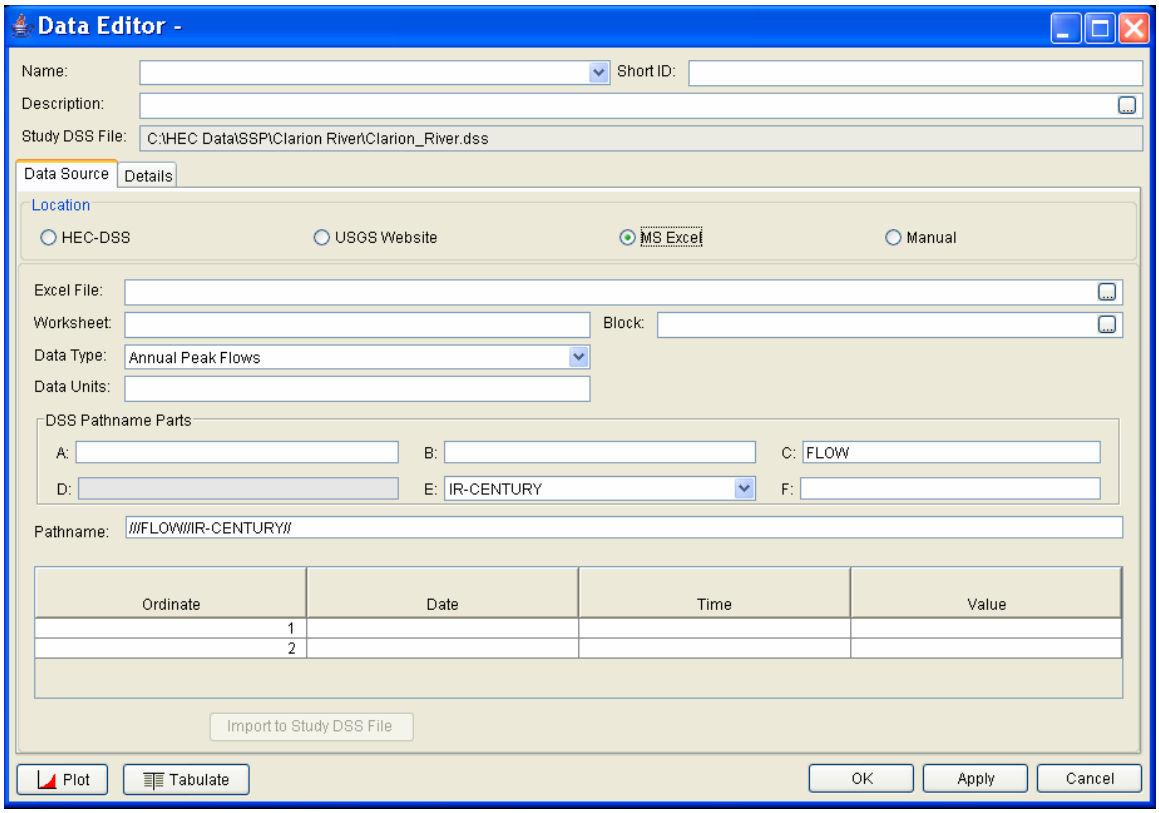


Figure 4-6. Data Editor with MS Excel Import Option Selected.

As shown in Figure 4-6, the first step in importing data from an Excel spreadsheet is to select browse ... at the end of the **Excel File** field. Once an Excel file is selected, a data view window will pop up showing the data contained in the selected spreadsheet. An example Excel Data viewer is shown in Figure 4-7.

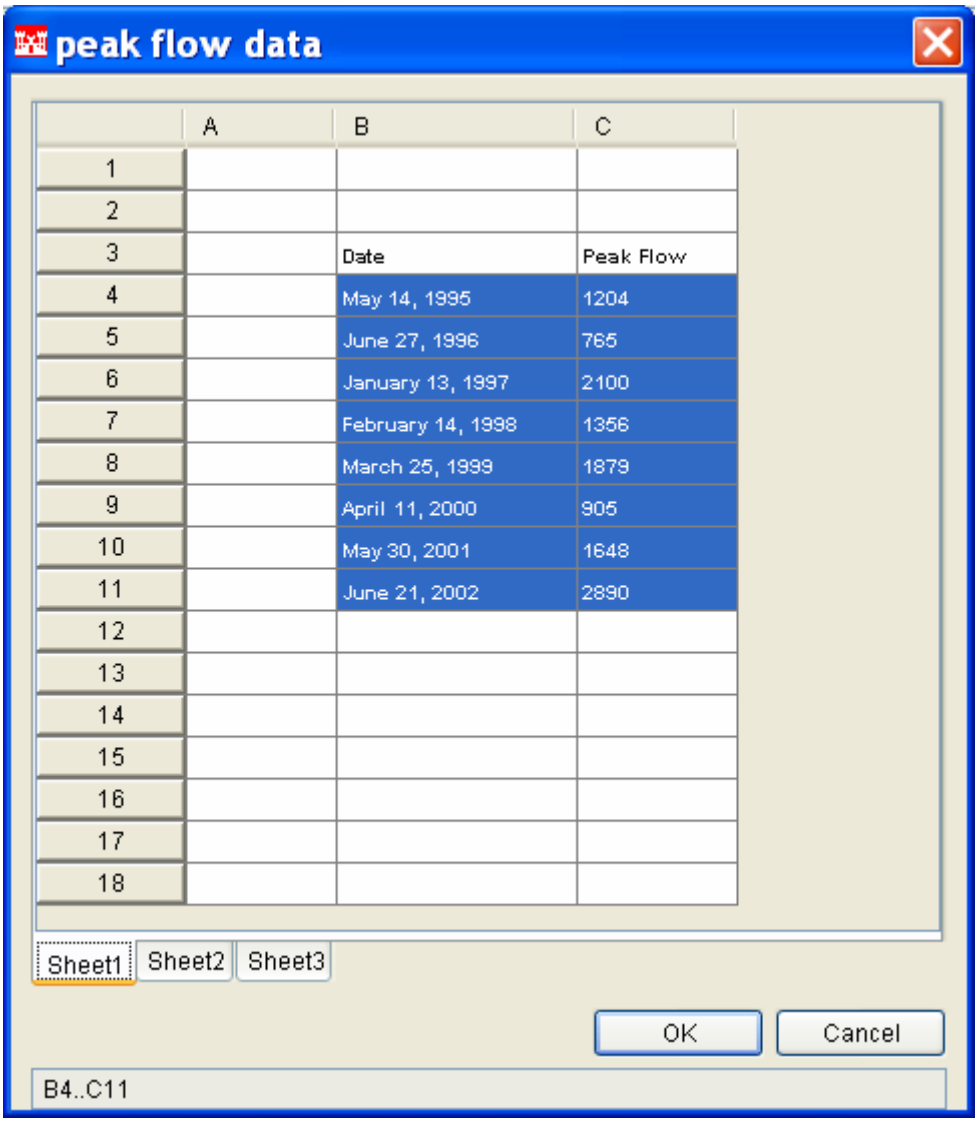


Figure 4-7. Example Excel Data Viewer.

The next step is to highlight the date and flow data values for each value to be imported into the study (only highlight the data, not the column headings). The data must be in a format of Date in the first column and Peak Annual Flow in the second column (optionally the user can have three fields of: Date; Time; and Flow). The date must either be in the Month, Day, Year format as shown in Figure 4-7, or "dd/mm/yyyy" format. Next press the **OK** button and the data will be placed in the table at the bottom of the editor. The last steps before importing the data is to specify the units of the data, and each of the

pathname parts for storing the data in the study DSS file. The final step is to press the **Import to Study DSS File** button, and the data will be imported.

Entering Data Manually

The last option for getting data into the study is to enter the data manually. When the **Manual** option is selected, the window will change to what is shown in Figure 4-8.

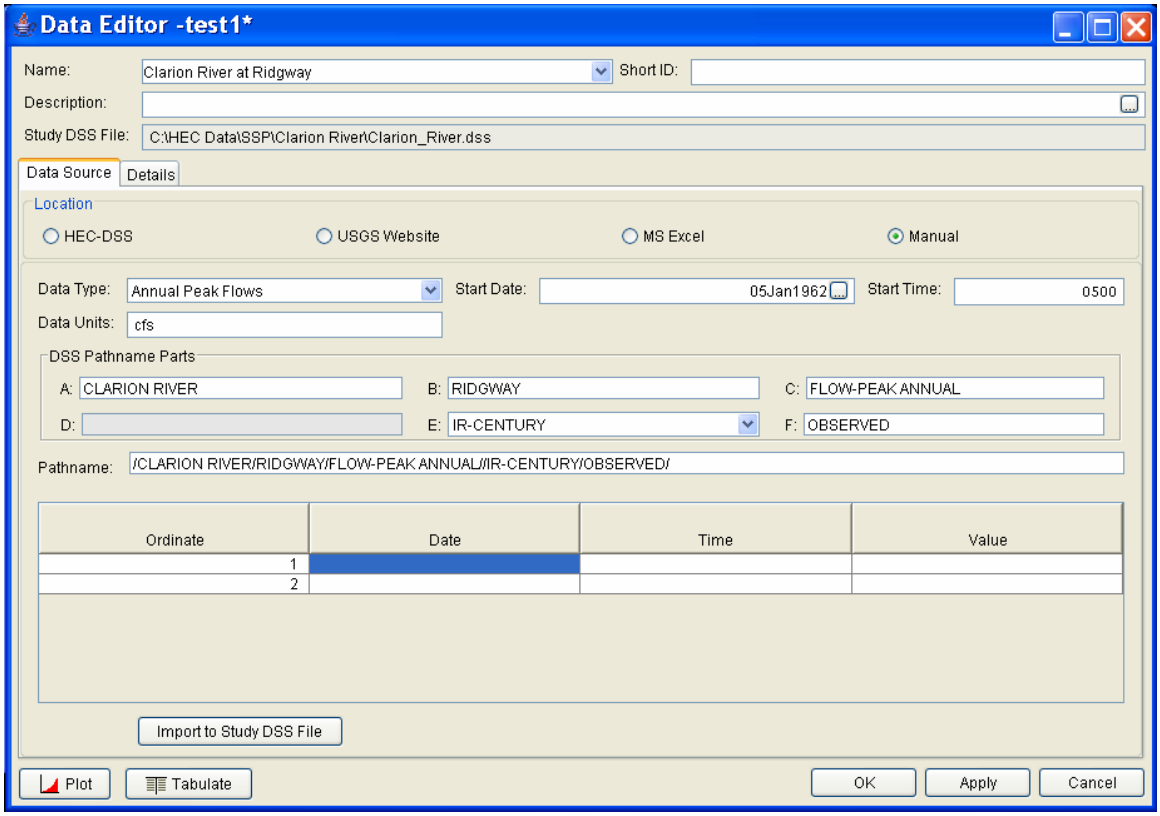


Figure 4-8. Data Editor with Manual Data Entry Option Selected.

To enter data manually, the user enters a name for the data set at the top, along with a short identifier and a description (optional). The Data Type is selected (currently only Annual Peak Flows is available), then the starting date and time should be entered. The units of the data must also be defined. The last step before entering the data is to specify the pathname parts for how the data will be stored into the study DSS file. Once all of the data labeling is completed, the data can be entered into the table at the bottom of the editor. The user must enter the Date, Time, and data Value for each peak flow value to be entered. Once all of the data are entered into the table, the user presses the **Import to Study DSS File** button and the data will be stored in the study.

Metadata

When downloading data from the USGS website, in addition to the raw data, the software will also attempt to download any metadata available for each gage location. The metadata will show up on the Details tab of the editor. The user can view the metadata by selecting the Details tab, as shown in Figure 4-9.

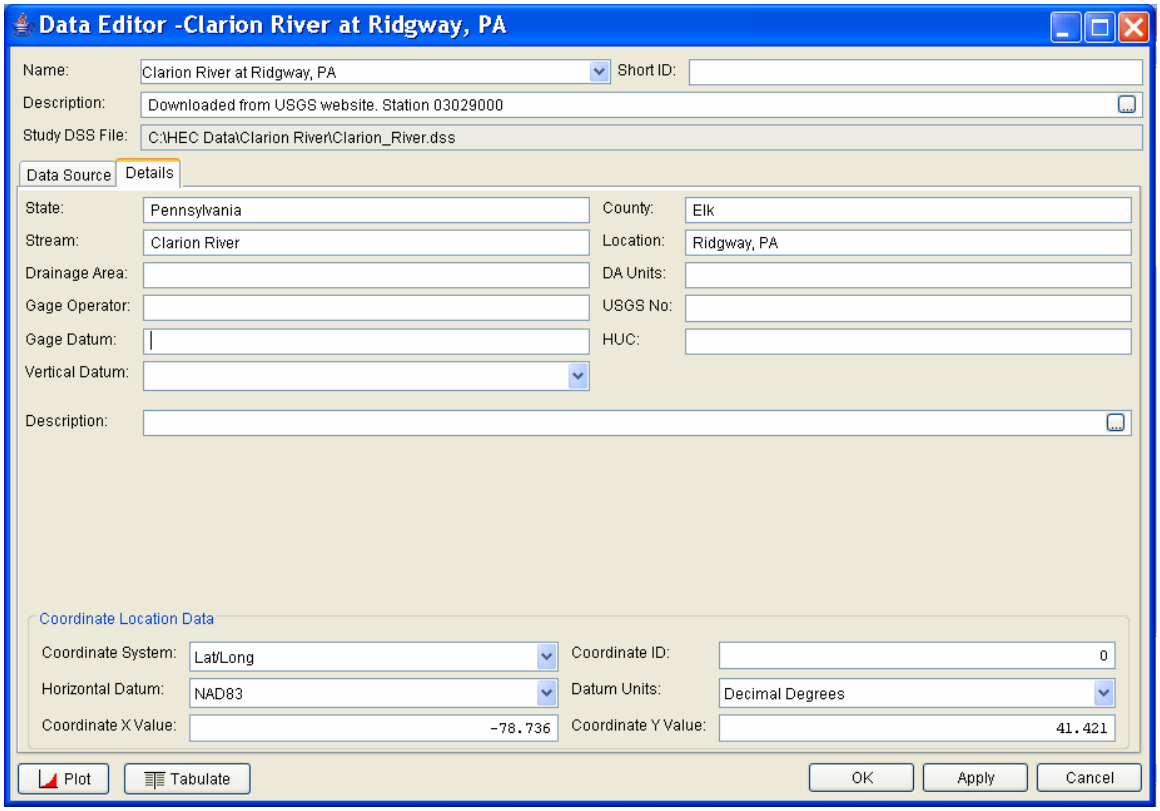


Figure 4-9. Details Tab on the HEC-SSP Data Editor.

As shown in Figure 4-9, the metadata consists of the: State; County; Stream; Location; Drainage Area; DA Units; Gage Operator; USGS Gage No.; Gage Datum; HUC (Hydrologic Unit Code); Vertical Datum; and a description field. Additionally, the coordinate location of the data is shown. The coordinate location data consists of: Coordinate System; Coordinate ID; Horizontal Datum; Datum Units; Coordinate X Value; and Coordinate Y Value. Most of the USGS data is in the Latitude/Longitude coordinate system as shown in the example. If coordinate system data are entered, data icons and text labels will show up on the background map at the specified locations.

If the metadata does not download automatically the user has the option to enter any of the information by hand. Metadata is not

generated automatically for any of the other three data acquisition methods. Therefore, entering the data is required if the user wants the data to be carried along with the study.

Plotting and Tabulating the Data

After the data is imported into the study, the user can select any one of the gages from the drop-down list located in the Name field at the top of the Data Editor. The user has the option to change the name of the data, enter a short identifier, and put in a longer description of the data. Additionally, at the bottom of the data editor is a plot and Tabulate button. If you press the **Plot** button you will get a plot of the peak flow data for that gage location. An example plot is shown below.

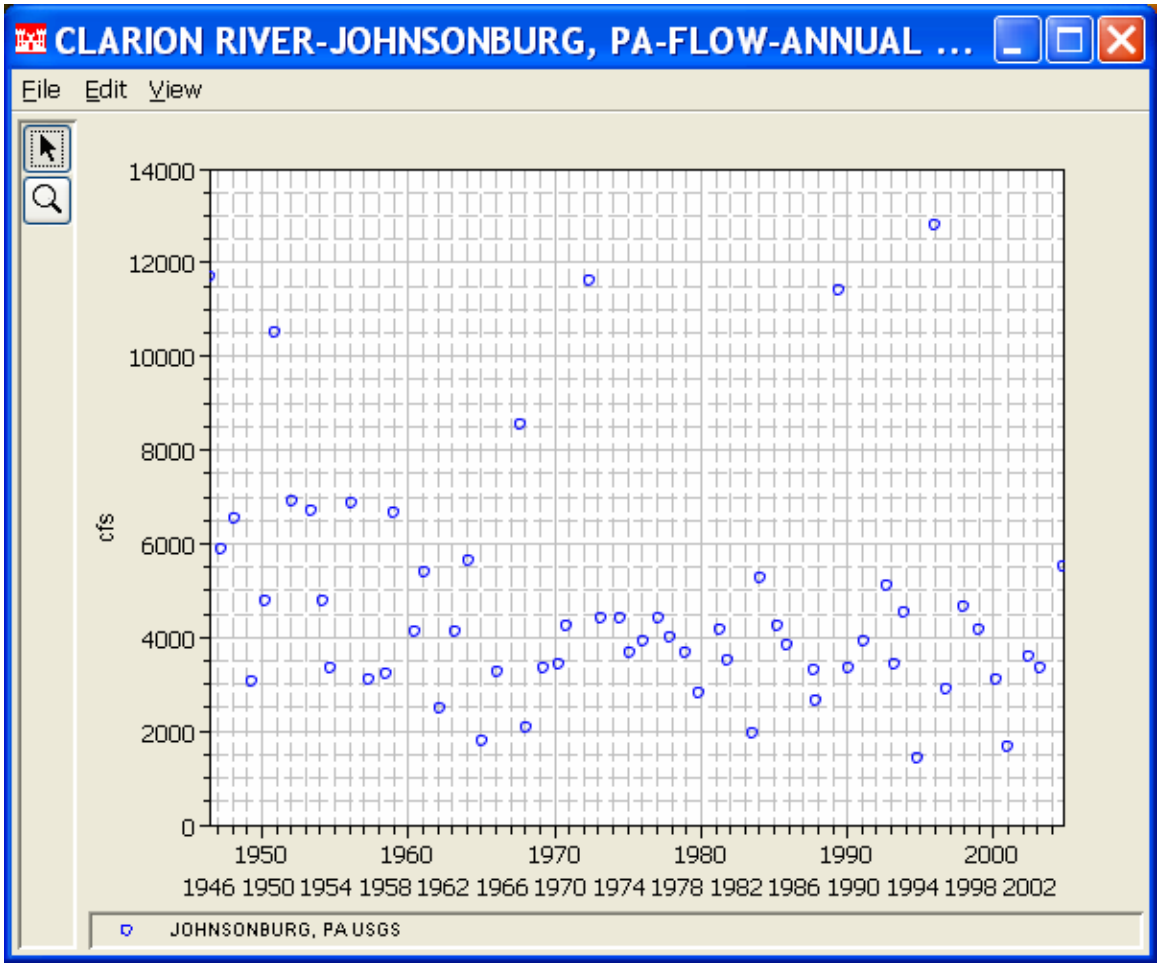


Figure 4-10. Plot of Peak Annual Flow Data Download from USGS Website.

If the user presses the **Tabulate** button at the bottom of the editor, a table will pop up with the data listed as shown in Figure 4-11.

/Clarion River/Ridgway...

File Edit View

Ordinate	Date / Time	RIDGWAY, PA USGS
Units		CFS
Type		INST-VAL
1	13 Dec 40 24:00	5,660
2	19 Jul 42 24:00	34,000
3	26 May 43 24:00	13,400
4	17 Mar 44 24:00	7,300
5	03 Mar 45 24:00	10,000
6	28 May 46 24:00	13,100
7	05 Apr 47 24:00	8,280
8	12 Apr 48 24:00	8,680
9	22 May 49 24:00	3,710
10	29 Mar 50 24:00	8,280
11	25 Nov 50 24:00	17,500
12	18 Jan 52 24:00	10,900
13	23 May 53 24:00	8,900
14	14 Aug 94 24:00	11,700
15	20 Jan 95 24:00	2,530
16	19 Jan 96 24:00	30,400
17	08 Nov 96 24:00	4,630
18	08 Jan 98 24:00	5,510
19	24 Jan 99 24:00	6,030
20	04 Apr 00 24:00	5,220
21	17 Dec 00 24:00	2,190
22	13 May 02 24:00	4,660
23	01 Aug 03 24:00	5,920
24	18 Sep 04 24:00	13,700

Figure 4-11. Example Table Containing a Listing of Peak Annual Flow data.

CHAPTER 5

Performing a Bulletin 17B Flow Frequency Analysis

The current version of HEC-SSP allows the user to perform flow frequency analyses based on Bulletin 17B, “Guidelines for Determining Flood Flow Frequency” (March 1982). This chapter discusses in detail how to perform a flow frequency analysis with HEC-SSP.

Contents

- Starting a New Analysis
- General Settings, Options, and Computations
- Viewing and Printing Results

Starting a New Analysis

A flow frequency analysis can be started in two ways within the software, either by right clicking on the Bulletin 17B folder in the study tree and selecting New, or by going to the **Analysis** menu and selecting **New** and then **Bulletin 17B Flow Frequency**. When a new flow frequency analysis is selected, the Bulletin 17B Editor will appear as shown in Figure 5-1.

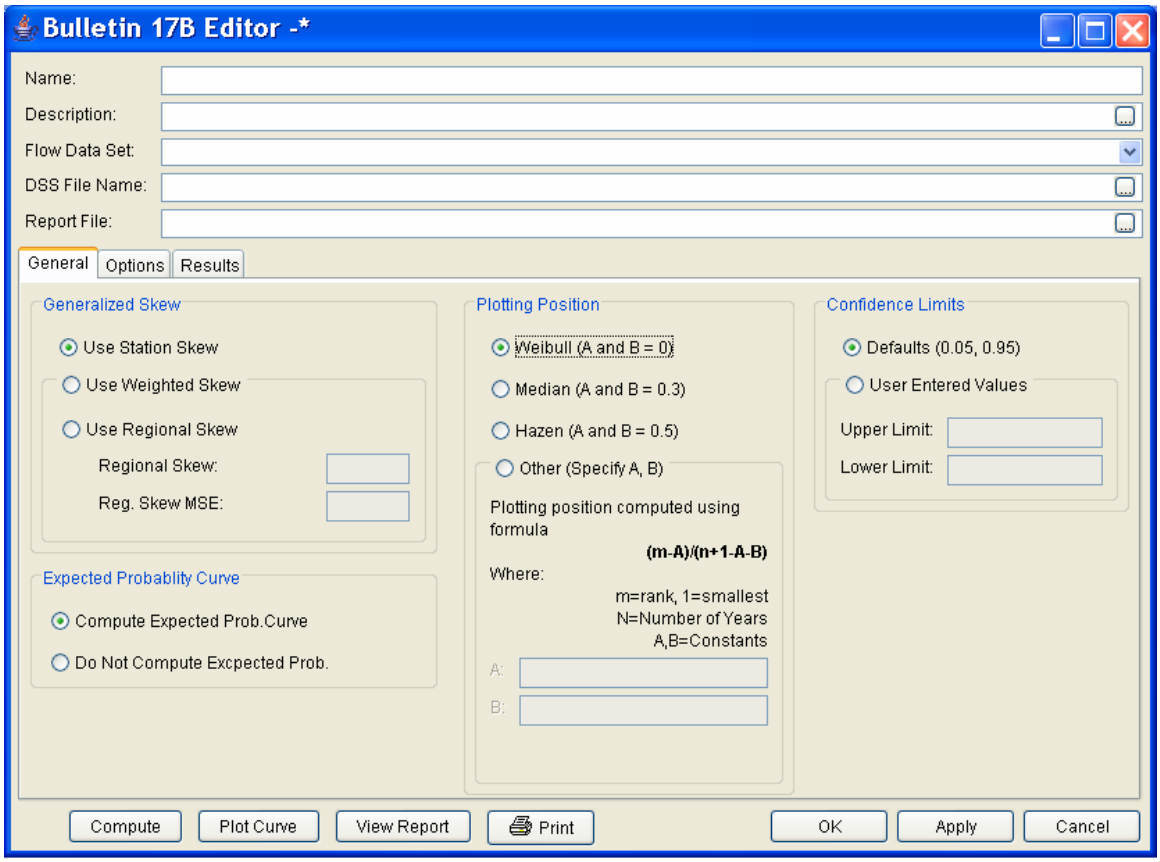


Figure 5-1. Bulletin 17B Flow Frequency Analysis Editor

The user is required to enter a **Name** for the analysis, while a **Description** is optional. A flow data set must be selected from the available data sets stored in the current study DSS file (see chapter 4 for importing data into the study). Once a Name is entered, and a flow data set is selected, the **DSS File Name** and **Report File** will automatically be filled out. The DSS filename is by default the same name as the study with the extension ".DSS". The report file is given the same name as the analysis with the extension ".rpt". These default file names can be changed by the user if desired, however, the extensions are required.

General Settings, Options, and Computations

Once the analysis name and flow data set are selected, the user can begin to perform the computations. Contained on the Bulletin 17B editor are three tabs. The tabs are labeled: **General**; **Options**; and **Results**.

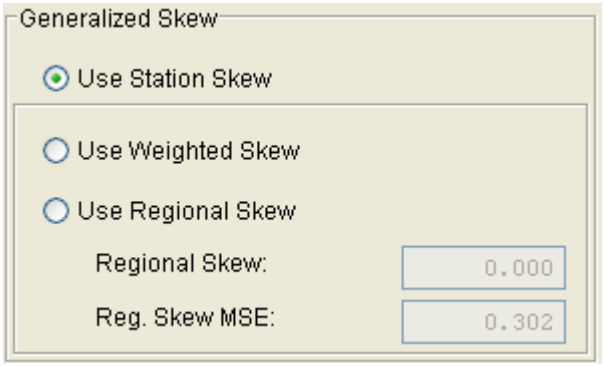
General Settings

The first tab contains general settings for performing the flow frequency analysis (Figure 5-1). These settings include:

- Generalized Skew
- Expected Probability Curve
- Plotting Positions
- Confidence Limits

Generalized Skew

There are three options contained within the generalize skew setting: Use Station Skew; Use Weighted Skew; and Use Regional Skew. The default skew setting is **Use Station Skew**. With this setting, the skew of the computed curve will be based solely on computing a skew from the data points contained in the data set, and no weighting will be performed.



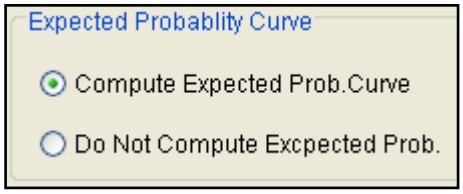
The **Use Weighted Skew** option requires the user to enter a generalized Regional Skew and a Mean-Square Error (MSE) of the generalized regional skew. This option weights the computed station skew with the generalized regional skew. The equation for performing this weighting can be found in Bulletin 17B (equation 6). If a regional skew is taken from Plate I of Bulletin 17B (the skew map of the United States), the value of MSE = 0.302. This value is set as a default for the MSE of the regional skew.

The last Generalized skew option is **Use Regional Skew**. When this option is selected, the user must enter a generalized regional skew and an MSE for that skew (default = 0.302). The program will ignore

the computed station skew and use only the generalized regional skew.

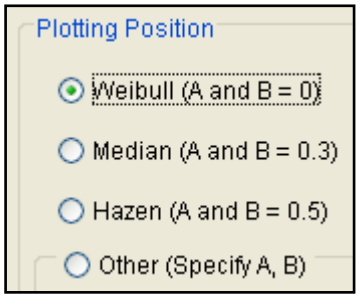
Expected Probability Curve

This setting has two options: Compute the expected probability curve and do not compute the expected probability curve. The default setting is to have the expected probability curve computed. When computed, this curve will be shown in both the tables and the plots as an additional curve to the computed curve. The expected probability adjustment is an attempt to correct for a certain bias in the frequency curve computation due to the shortness of the record. Please review the discussion in Bulletin 17B about the expected probability curve adjustment for an explanation of how and why it is computed. The use of the expected probability curve is a policy decision. It is most often used in establishing design flood criteria. The basic flood frequency curve without the expected probability curve adjustment is the curve used in computation of confidence limits, risk, and in obtaining weighted averages of independent estimates of flood frequency discharge (WRC, 1982).



Plotting Positions

Plotting positions are used for plotting the raw data points on the graph. There are four options for plotting position methodologies within HEC-SSP: Weibull; Median; Hazen; and user entered coefficients. The default method is the Weibull plotting position formula. The generalized plotting position equation is:



$$P = \frac{(m-a)}{(n+1-a-b)}$$

Where: m = rank of flood values with the largest equal to 1.

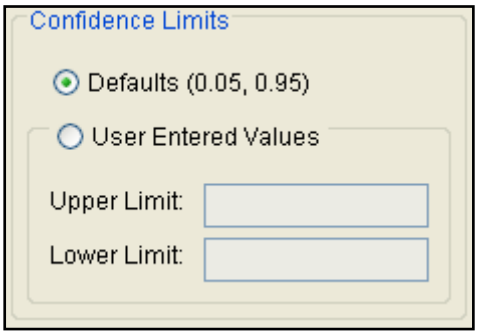
n = number of flood peaks in the data set.

a & b = constants dependent on which equation is used (Weibull a and b=0; Median a and b = 0.3; and Hazen a and b=0.5).

Plotting positions are estimates of the exceedance probability of each data point. Different methods can give very different values for the probabilities of the highest and lowest points in the data set. In the Bulletin 17B methodology, the plotting of data on the graph by a plotting position method is only done as a guide to assist in evaluating the computed curve. The plotting position method selected does not have any impact on the computed curve.

Confidence Limits

Confidence limits provide a measure of the uncertainty in the computed discharge for a given exceedance probability. The computation of confidence limits is outlined in Bulletin 17B appendix 9. By default, HEC-SSP calculates the 90 percent confidence interval (i.e. the 5% and 95% confidence limits). The confidence limits must be entered in decimal form (i.e. 95% = 0.95, and 5% = 0.05). The user has the option to override the default values and enter whatever values they would like for the confidence limits.



Options

In addition to the general settings, there are also several options available to the user for modifying the computations of the frequency curves. These options include:

- Low Outlier Threshold
- Historic Period Data
- User-Specified Frequency Ordinates

When the Options tab is selected, the Bulletin 17B Editor will appear as shown in Figure 5-2:

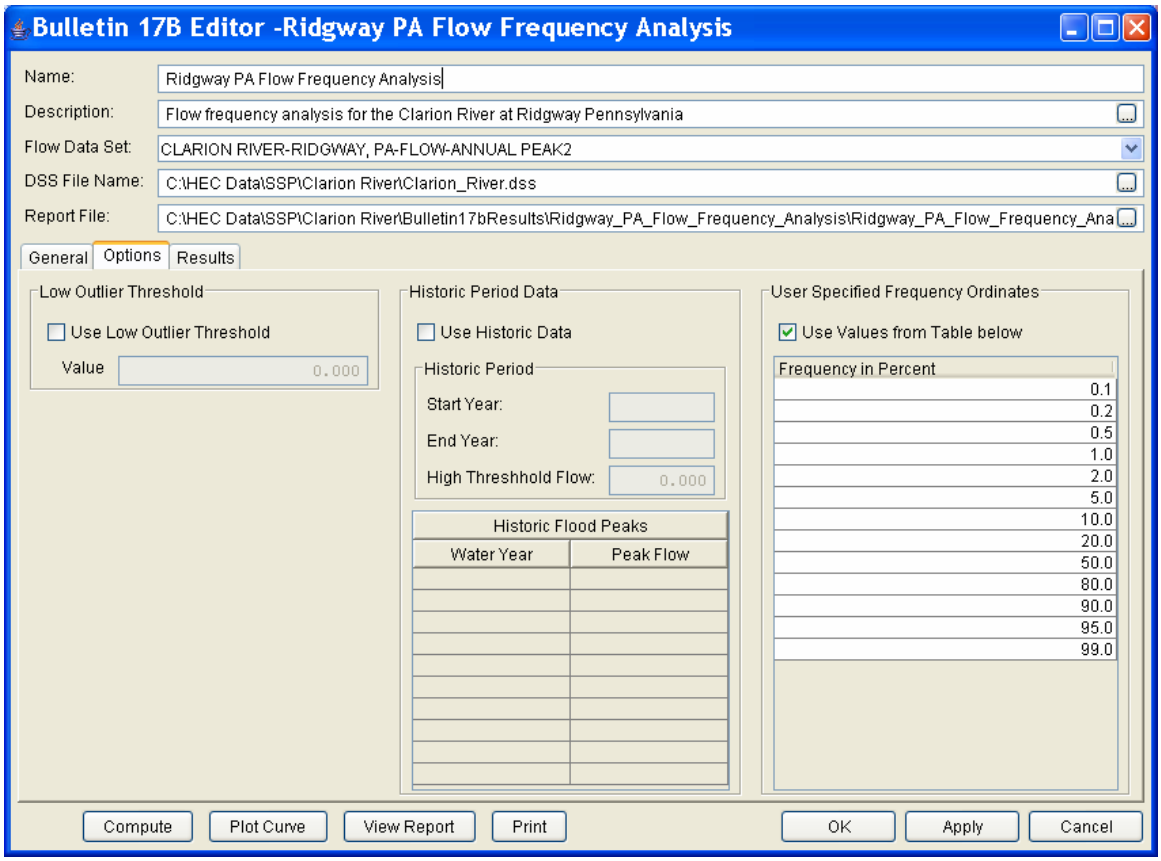
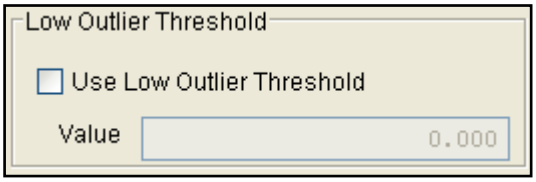


Figure 5-2. Bulletin 17B Editor with Options Tab Selected.

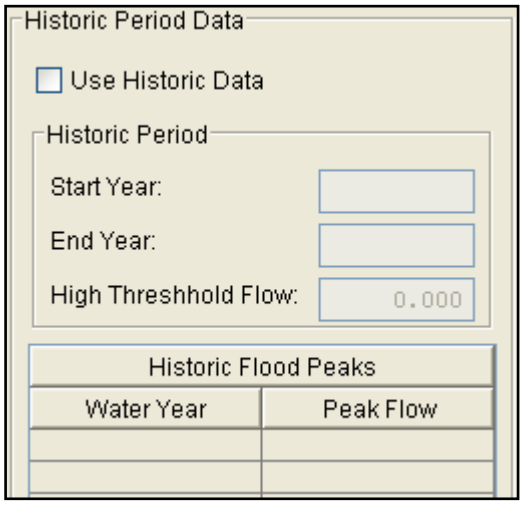
Low Outlier Threshold

High and low outlier tests are based on the procedures outlined in Bulletin 17B. The calculated outlier magnitudes, by the Bulletin 17B methods, are used as default values for the high and low outlier thresholds in HEC-SSP. The user has the option to enter a different value for the low outlier threshold. If a value is entered for the low outlier threshold, then this value will override the computed value from Bulletin 17B. Further discussion of outlier thresholds can be found in Bulletin 17B and the HEC-SSP Statistical Reference Guide. To use the low outlier threshold, simply check the box and enter the value.



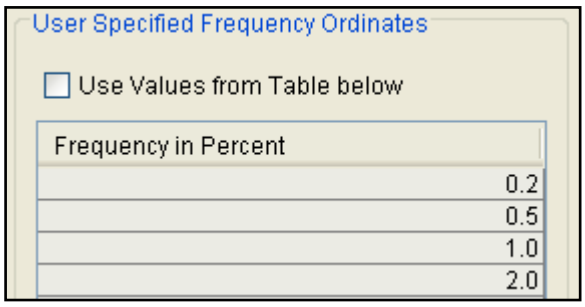
Historic Period Data

Any historic data that provides reliable estimates of flood peaks outside the systematic record should be used in order to modify and improve the frequency computations. Flood information outside of the systematic record can often be used to extend the record of the largest events to a historic period much larger than that of the systematic record. HEC-SSP uses historic data as recommended in Bulletin 17B. To use historic data in HEC-SSP, check the box labeled **Use Historic Data**. The user can enter a starting year for the historic period, ending year for a historic period, and a High Threshold Flow value. If the user enters a high threshold Flow value, then any flow in the systematic record greater than that value will also be treated as a historical flood peak. The user can also enter historic flood peaks that are not contained in the systematic record. This is done in the table at the bottom labeled **Historic Flood** Peaks. All years must be entered as water year values (October 1 through September 30). If a start year is not entered, then the assumed start year is the earliest year of the systematic record and any historical values that have been entered. If an end year is not entered, then the assumed end year is the latest year in the systematic record and any entered historic values. Further discussion of the use of historical data can be found in Bulletin 17B and the HEC-SSP Statistical Reference Guide.



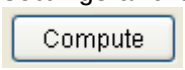
User Entered Frequency Ordinates

This option allows the user to change the frequency ordinates used in computing the resulting frequency curves and confidence limits. The default values listed in percent chance exceedance are: 0.2, 0.5, 1, 2, 5, 10, 20, 50, 80, 90, 95, and 99. The user can change these values and/or add additional values. All values must be between 0 and 100.



Computations

Once the new analysis has been defined, and the user has all of the settings and options the way they want them, performing the computations is simply a matter of pressing the **Compute** button at the bottom of the Bulletin 17B Editor.



Once the compute button is pressed, the flow frequency computations are performed. If the computations are successful, the user will receive a message that says “Compute Complete”. At this point, the user can begin to review the results of the flow frequency computations.

Viewing and Printing Results

The user can view output from the flow frequency analysis directly from the Bulletin 17B Editor. The output consists of tabular results, a frequency curve plot, and a report documenting the data and computations performed.

Tabular Output

Once the computations for the flow frequency analysis are completed, the user can view tabular output by simply left clicking on the **Results** tab. When this tab is pressed, the results will be displayed as shown in Figure 5-3.

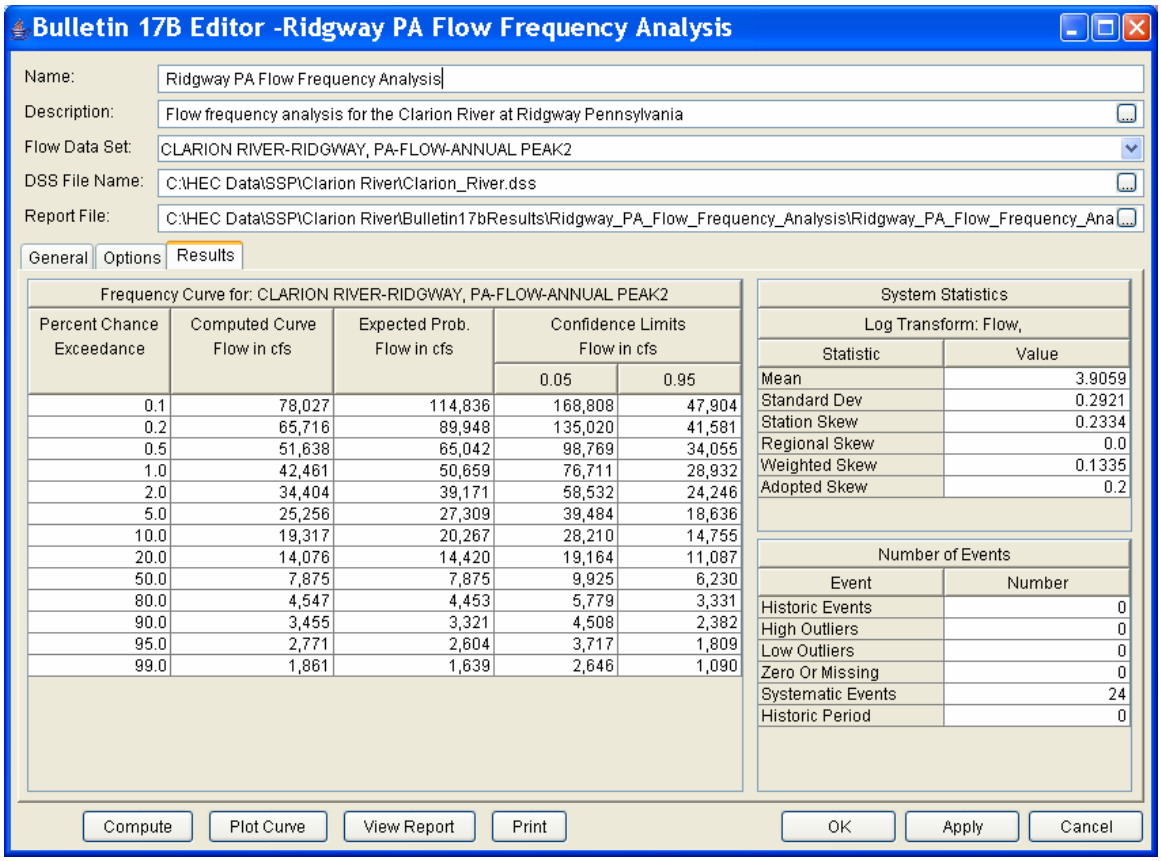


Figure 5-3. Bulletin 17B Editor with Tabular Results Tab Active.

Output on the results tab consists of three tables: frequency curves; statistics; and event information. The primary output table contains: the percent chance of exceedance ordinates; the computed Log Pearson III frequency curve; the expected probability adjusted frequency curve; the 5% chance of exceedance confidence limit; and the 95% chance of exceedance confidence limit. The statistics table consists of: the mean of the data in log space; standard deviation in log space; station skew; user entered regional skew; weighted skew (weighted between station skew and regional skew); and the adopted skew for the analysis. The final table is a listing of the number of events for the following: historic events; high outliers; low outliers; zero or missing values; systematic events; and the number of years in the historic period (this value only comes into play if the user entered historic data).

The tabular results can be printed by using the **Print** button at the bottom of the Bulletin 17B Editor. When the print button is pressed, a window will appear giving the user options for how they would like the table to be printed.

Graphical Output

Graphical output of the frequency curves can be obtained by pressing the **Plot Curve** button. When the Plot Curve button is pressed, a frequency curve plot will appear in a separate window as shown in Figure 5-4.

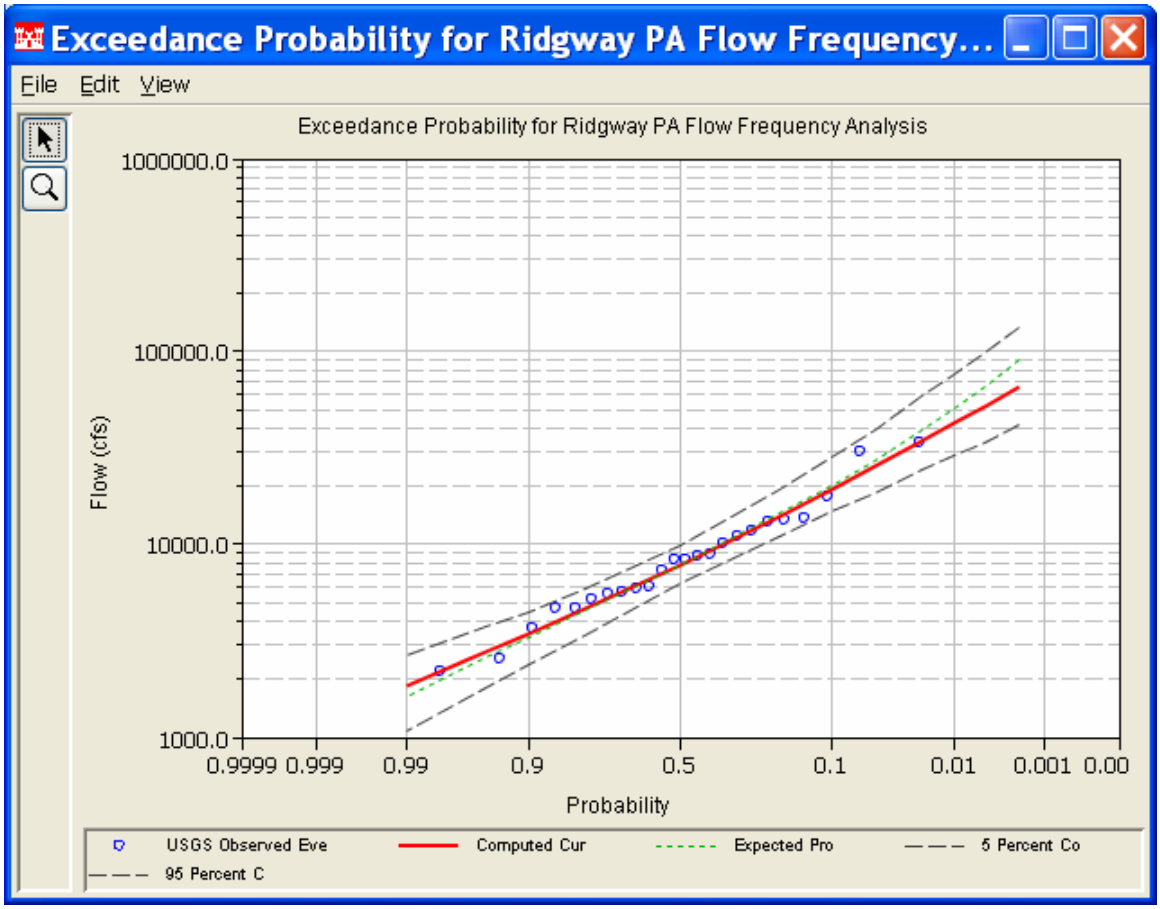


Figure 5-4. Example Frequency Curve Plot.

The frequency curve plot can be sent to the printer by selecting the **Print** option from the **File** menu at the top of the window. Additional printing options available from the File menu are: Page Setup; Print Preview; and Print Multiple (used for printing multiple graphs on the same page). The graphic can also be sent to the Windows Clipboard by selecting **Copy to Clipboard** from the File menu. Additionally the plot can be saved to a file by selecting the **Save As** option from the File menu. When the Save As option is selected a pop up window will appear allowing the user to select a directory, enter a filename, and select the format for saving the file. Currently four file formats are available for saving the graphic to disk: windows metafile; postscript; JPEG; and portable network graphic.

The data contained within the plot can also be tabulated by selecting **Tabulate** from the File menu on the plot. When this option is selected a separate window will appear with the data tabulated.

Additional options are available from the File menu for saving the graphics options as a template (**Save Template)** and applying previously saved templates to the current graphic (**Apply Template**).

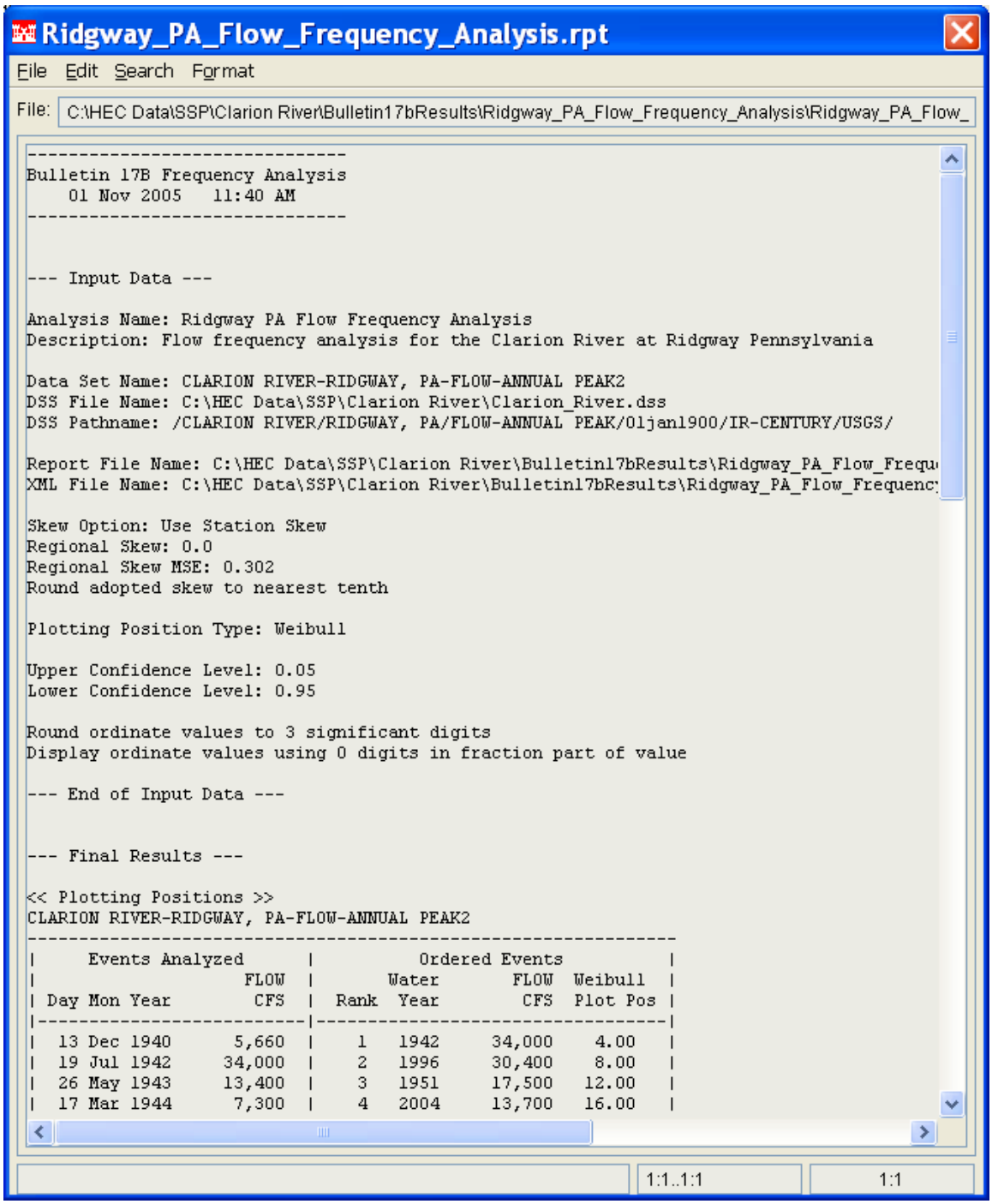
The **Edit** menu on the graphic window contains several options for customizing the graphic. These options include: Plot Properties; Configure Plot Layout; Default Line Styles; and Default Plot Properties. Also, when the user right-clicks on the graphic or a particular line on the graphic, a pop up menu will appear with further customizing options.

The graphic customizing capabilities within HEC-SSP are very powerful, but are also somewhat complex to use. The software used in developing the plots in HEC-SSP is the same code that was used for developing graphics in HEC-DSSVue and several other HEC software programs. A separate write-up on Customizing Graphics can be found in Appendix C of this manual. Please refer to that appendix for details on using the graphics customizing options.

Viewing the Report File

When the Bulletin 17B computations are performed, the computations module writes a report file of the statistical computations. The report file lists all of the input data and user settings; plotting positions of the data points; intermediate results; each of the various statistical tests performed (i.e. high and low outliers, historical data, etc…); and the final results. This file is often useful for understanding how the software arrived at the final frequency curve.

To view the Report file press the **View Report** button at the bottom of the Bulletin 17B Analysis window. When this button is pressed a window will appear containing the text report as shown in Figure 5-5.



Ridgway_PA_Flow_Frequency_Analysis.rpt

File Edit Search Format

File: C:\HEC Data\SSP\Clarion River\Bulletin17bResults\Ridgway_PA_Flow_Frequency_Analysis\Ridgway_PA_Flow_

```
-------------------------------
Bulletin 17B Frequency Analysis
    01 Nov 2005   11:40 AM
-------------------------------


--- Input Data ---

Analysis Name: Ridgway PA Flow Frequency Analysis
Description: Flow frequency analysis for the Clarion River at Ridgway Pennsylvania

Data Set Name: CLARION RIVER-RIDGWAY, PA-FLOW-ANNUAL PEAK2
DSS File Name: C:\HEC Data\SSP\Clarion River\Clarion_River.dss
DSS Pathname: /CLARION RIVER/RIDGWAY, PA/FLOW-ANNUAL PEAK/01jan1900/IR-CENTURY/USGS/

Report File Name: C:\HEC Data\SSP\Clarion River\Bulletin17bResults\Ridgway_PA_Flow_Frequ
XML File Name: C:\HEC Data\SSP\Clarion River\Bulletin17bResults\Ridgway_PA_Flow_Frequenc

Skew Option: Use Station Skew
Regional Skew: 0.0
Regional Skew MSE: 0.302
Round adopted skew to nearest tenth

Plotting Position Type: Weibull

Upper Confidence Level: 0.05
Lower Confidence Level: 0.95

Round ordinate values to 3 significant digits
Display ordinate values using 0 digits in fraction part of value

--- End of Input Data ---


--- Final Results ---

<< Plotting Positions >>
CLARION RIVER-RIDGWAY, PA-FLOW-ANNUAL PEAK2
---------------------------------------------------------------
|     Events Analyzed      |          Ordered Events          |
|                    FLOW  |       Water       FLOW  Weibull  |
| Day Mon Year        CFS  |  Rank  Year        CFS  Plot Pos |
|--------------------------|----------------------------------|
|  13 Dec 1940      5,660  |    1   1942     34,000    4.00   |
|  19 Jul 1942     34,000  |    2   1996     30,400    8.00   |
|  26 May 1943     13,400  |    3   1951     17,500   12.00   |
|  17 Mar 1944      7,300  |    4   2004     13,700   16.00   |
```

1:1..1:1 1:1

Figure 5-5. Example of the Bulletin 17B Report File.

APPENDIX A

References

Interagency Advisory Committee on Water Data, March 1982. Bulletin 17B, “Guidelines for Determining Flood Flow Frequency”, Published by the U.S. Department of the Interior, Geologic Survey.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, May 1992. HEC-FFA, Flood Frequency Analysis, User’s Manual.

APPENDIX B

Example Data Sets

The input and output for six example data sets are provided to illustrate the use of selected options and to assist in verifying the correct execution of the program.

These example data sets are the same examples that were found in the HEC-FFA program documentation. As can be seen from this Appendix, the HEC-SSP software produces the same results as HEC-FFA for these six data sets. All of these test examples are provided with the software as a single HEC-SSP study labeled "FFA Tests".

A brief description of each test example is provided. In all cases the weighted skew option was selected, and a regional skew value was entered from the generalized skew map of the United States provided within Bulletin 17B (Plate 1).

The example problems shown in this section are entitled:

1. Fitting the Log-Pearson Type III Distribution.
2. Analysis with High Outliers.
3. Testing and Adjusting for a Low Outlier.
4. Zero Flood Years.
5. Confidence Limits and Low Threshold Discharge.
6. Use of Historic Data and Median Plotting Positions.

When the "FFA Tests" study file is open from HEC-SSP, the screen will appear as shown in Figure B-1.

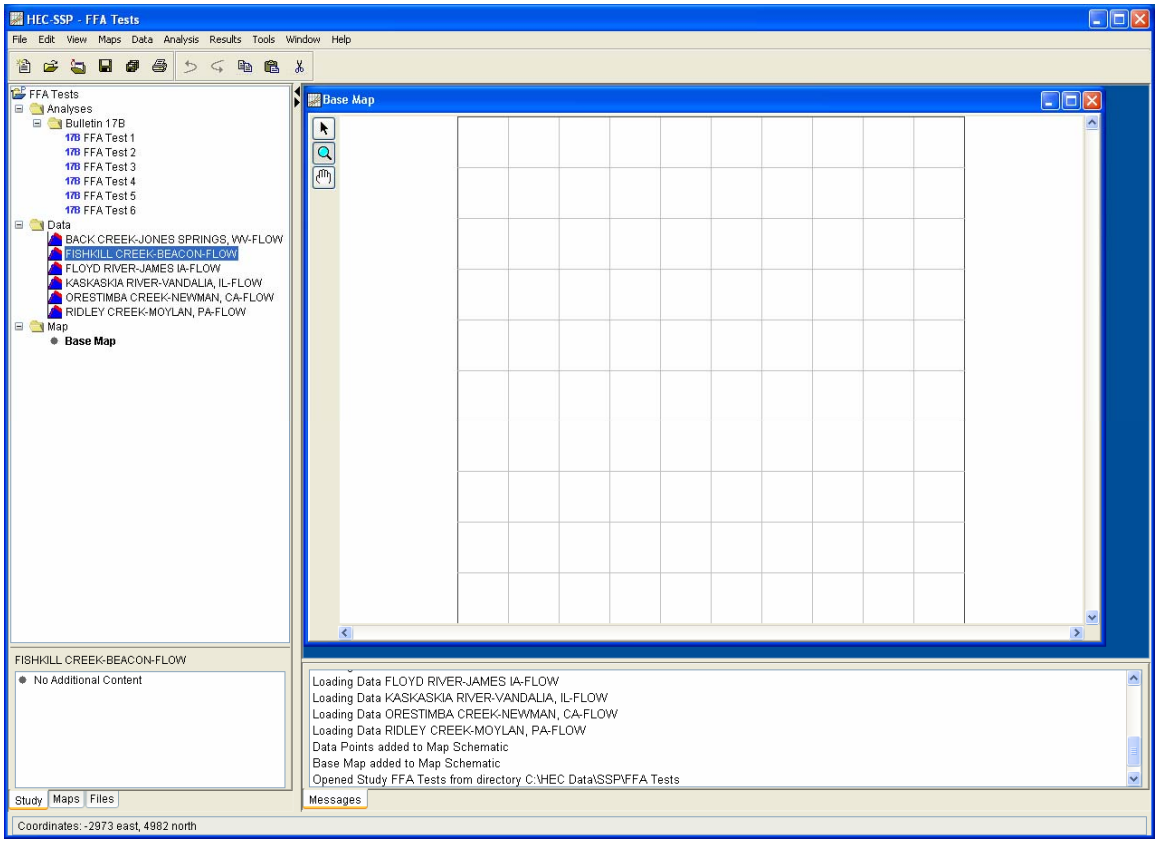


Figure B - 1. Opening Screen for HEC-SSP with the FFA Tests study open.

As shown in Figure B-1, there are 6 data records and 6 Bulletin 17B analyses in this study. The following sections document each of the 6 example data sets.

Example 1: Fitting the Log-Pearson Type III Distribution

The input data for the HEC-SSP Example 1 is the same as that for Example 1 in Appendix 12, Guidelines for Determining Flood Flow Frequency, Water Resources Council Bulletin 17B, September 1981. Example 1 illustrates the routine computation of a frequency curve by the Bulletin 17B methodology.

The data for this example is from Fishkill Creek in Beacon, New York. The period of record used for this example is from 1945 to 1968. To view the data from HEC-SSP, right-click on the data record labeled "**FISHKILL CREEK – BEACON- FLOW**" in the study pane, then select **Tabulate**. The data will appear as shown in Figure B-2.

/FISHKILL CREEK/BEACON/FLOW/01...

File Edit View

Ordinate	Date / Time	BEACON FLOW
Units		cfs
Type		INST-VAL
1	05 Mar 45 12:00	2,290.0
2	27 Dec 45 12:00	1,470.0
3	14 Mar 47 24:00	2,220.0
4	18 Mar 48 24:00	2,970.0
5	01 Jan 49 24:00	3,020.0
6	09 Mar 50 12:00	1,210.0
7	01 Apr 51 12:00	2,490.0
8	12 Mar 52 12:00	3,170.0
9	25 Jan 53 12:00	3,220.0
10	13 Sep 54 12:00	1,760.0
11	20 Aug 55 12:00	8,800.0
12	16 Oct 55 12:00	8,280.0
13	10 Apr 57 12:00	1,310.0
14	21 Dec 57 12:00	2,500.0
15	11 Feb 59 12:00	1,960.0
16	06 Apr 60 12:00	2,140.0
17	26 Feb 61 12:00	4,340.0
18	13 Mar 62 12:00	3,060.0
19	28 Mar 63 12:00	1,780.0
20	26 Jan 64 12:00	1,380.0
21	09 Feb 65 12:00	980.0
22	15 Feb 66 12:00	1,040.0
23	30 Mar 67 12:00	1,580.0
24	19 Mar 68 12:00	3,630.0

Figure B - 2. HEC-SSP Tabulation of the Peak Flow Data for Fishkill Creek.

To plot the data for this example, right-click on the data record again, then select **Plot**. A plot of the data will appear as shown in Figure B-3.

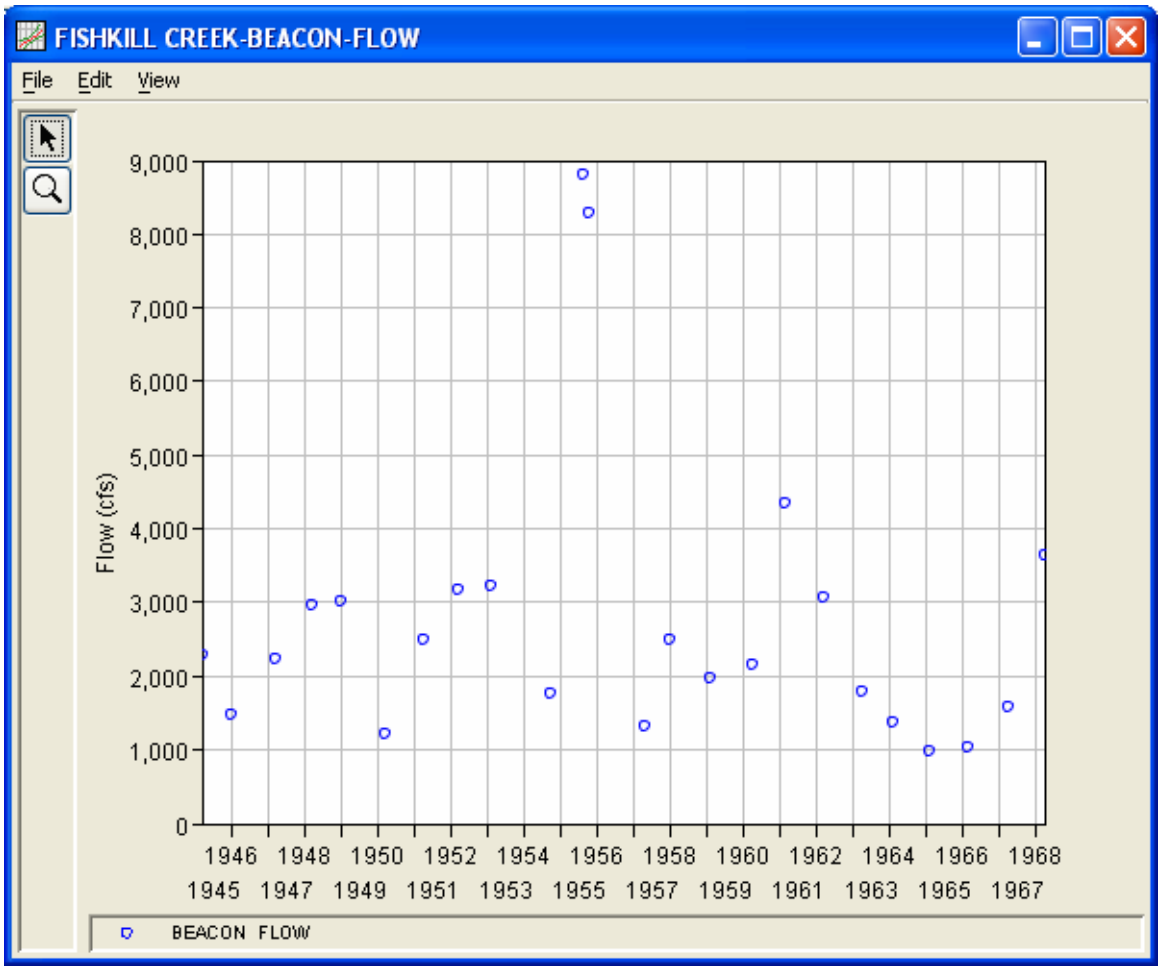


Figure B - 3. HEC-SSP Plot of the Fishkill Creek Data.

A Bulletin 17B analysis set has been developed for each of the test examples. To open the Bulletin 17B analysis editor for test example 1, either double-click on the analysis labeled **FFA Test 1** from the Study Pane, or from the **Analysis** menu select open, then select **FFA Test 1** from the list of available analyses. When FFA Test 1 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-4.

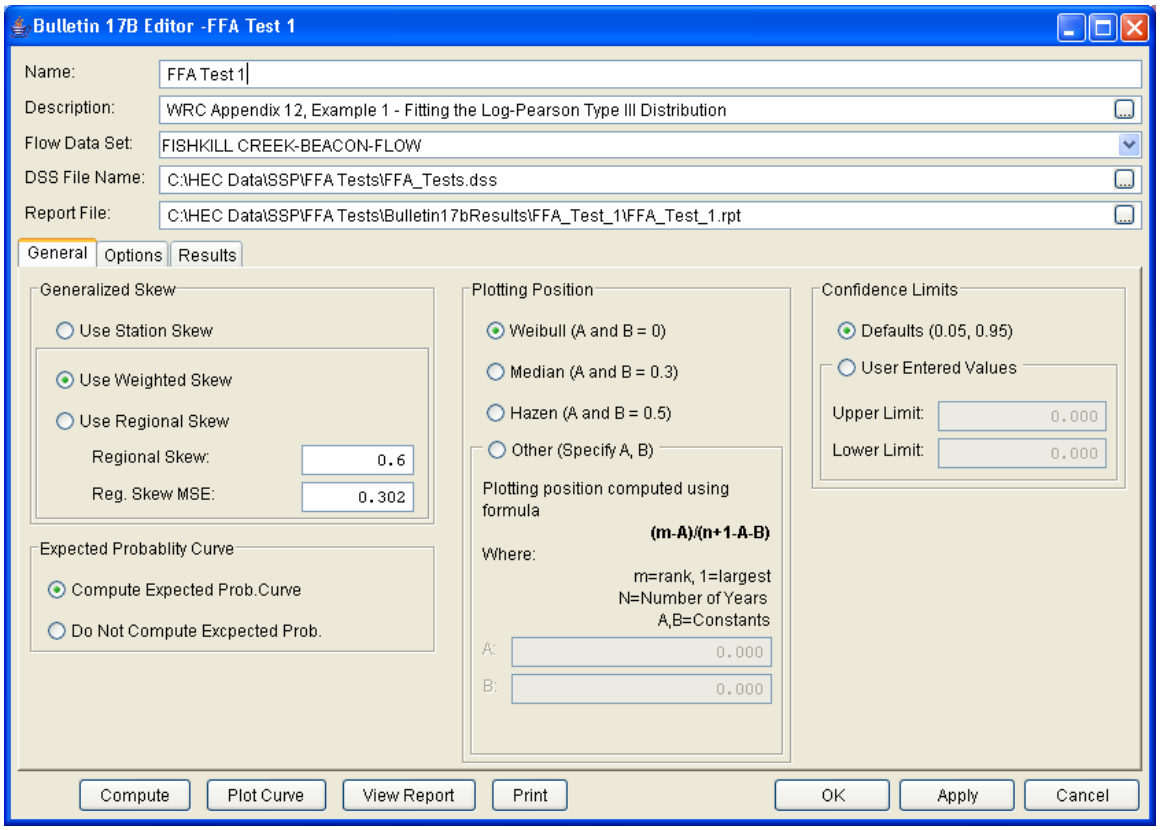


Figure B - 4. Bulletin 17B Analysis Editor with Test Example 1 Data Set.

Shown in Figure B-4 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of 0.6 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve.

The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance).

Shown in Figure B-5 is the Bulletin 17B editor with the **Options Tab** selected.

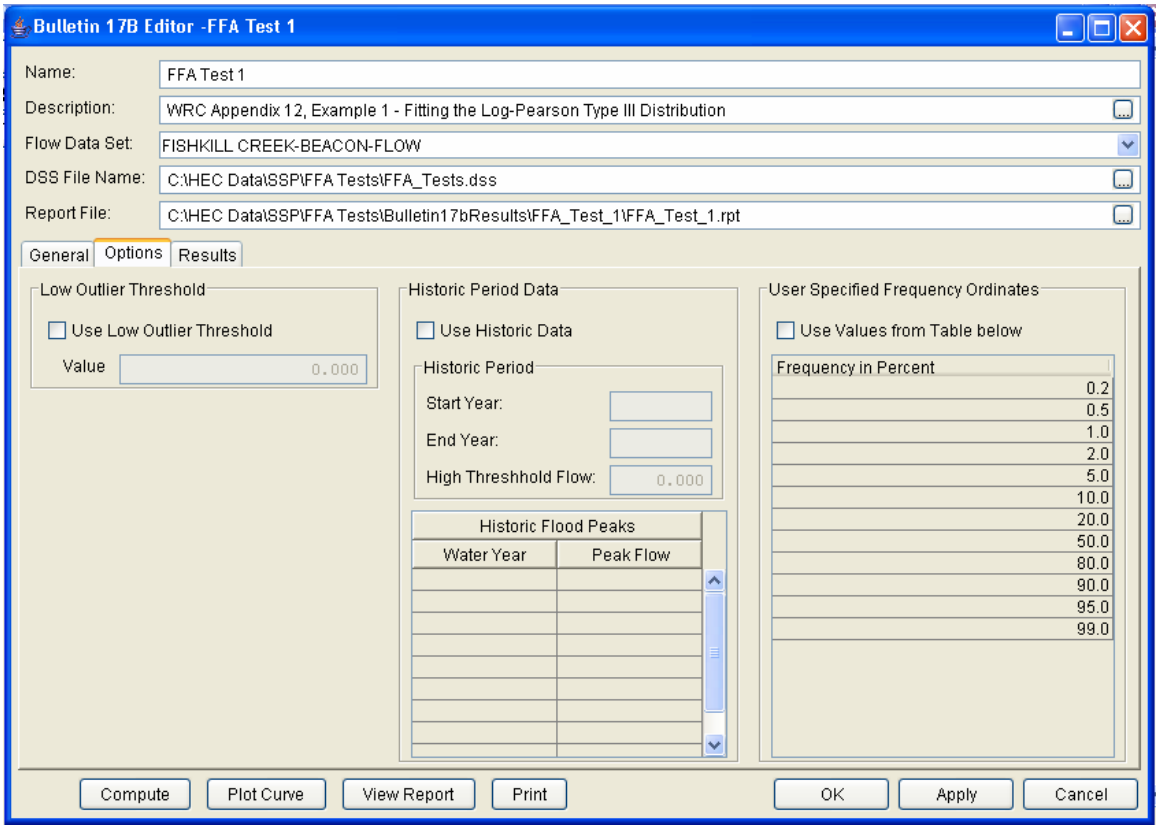
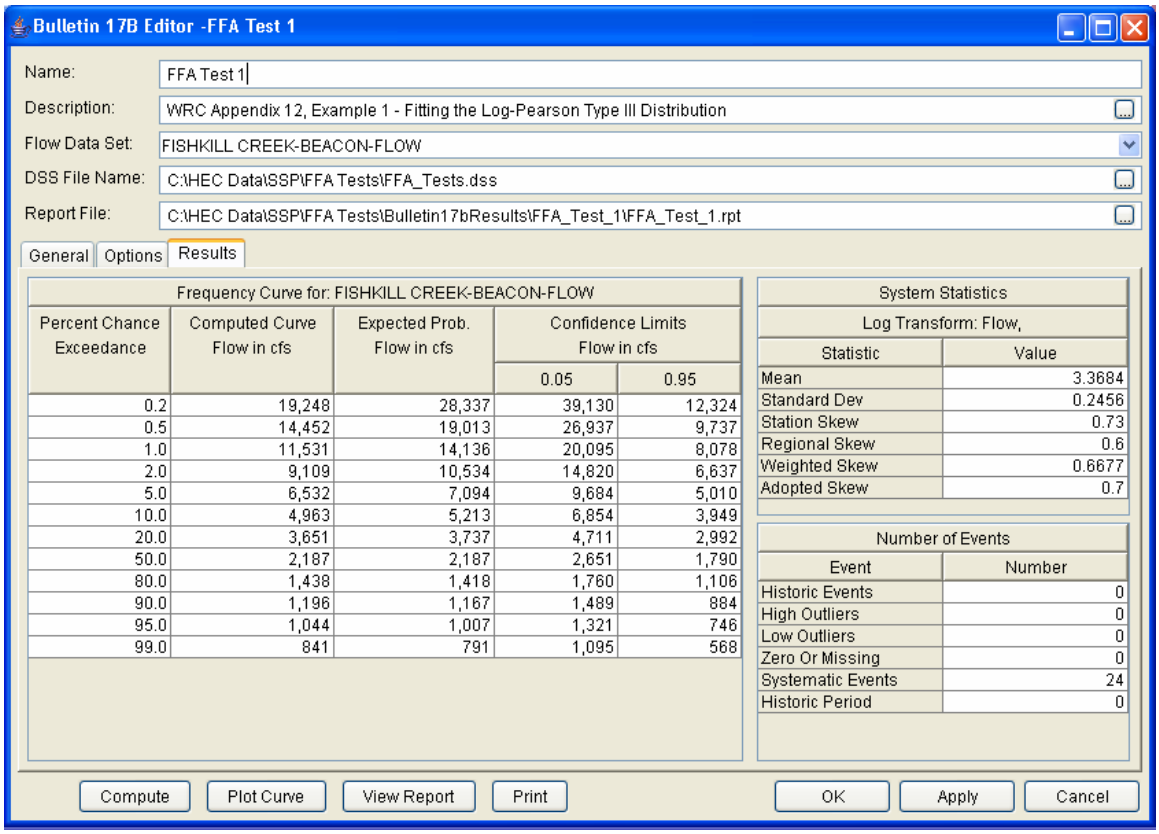


Figure B - 5. Bulletin 17B Editor with Options Tab Selected.

As shown in Figure B-5, none of the available options for modifying the frequency analysis were selected for this test example. These options include changing the **Low Outlier Threshold** and using **Historic Data**. Additionally, the option to override the default **Frequency Ordinates** was not selected.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the computations. If the data has been entered correctly, once the computations have been completed a message window will pop up and say **Compute Completed.** Close this window and then select the **Results Tab** from the analysis window. The analysis window should look like Figure B-6.



Frequency Curve for: FISHKILL CREEK-BEACON-FLOW

Percent Chance Exceedance	Computed Curve Flow in cfs	Expected Prob. Flow in cfs	Confidence Limits Flow in cfs	
			0.05	0.95
0.2	19,248	28,337	39,130	12,324
0.5	14,452	19,013	26,937	9,737
1.0	11,531	14,136	20,095	8,078
2.0	9,109	10,534	14,820	6,637
5.0	6,532	7,094	9,684	5,010
10.0	4,963	5,213	6,854	3,949
20.0	3,651	3,737	4,711	2,992
50.0	2,187	2,187	2,651	1,790
80.0	1,438	1,418	1,760	1,106
90.0	1,196	1,167	1,489	884
95.0	1,044	1,007	1,321	746
99.0	841	791	1,095	568

System Statistics
Log Transform: Flow,

Statistic	Value
Mean	3.3684
Standard Dev	0.2456
Station Skew	0.73
Regional Skew	0.6
Weighted Skew	0.6677
Adopted Skew	0.7

Number of Events

Event	Number
Historic Events	0
High Outliers	0
Low Outliers	0
Zero Or Missing	0
Systematic Events	24
Historic Period	0

Figure B - 6. Bulletin 17B Analysis Window with Results Tab Shown.

As shown in Figure B-6, the left table on the results tab contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the right-hand side of the results tab is a table of statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the right-hand side of the results tab is a table showing: the number of historic events used in the analysis; number of high outliers found; number of low outliers; number of zero or missing data years; number of systematic events in the gage record; and the historic record length (if historic data was entered).

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-7.

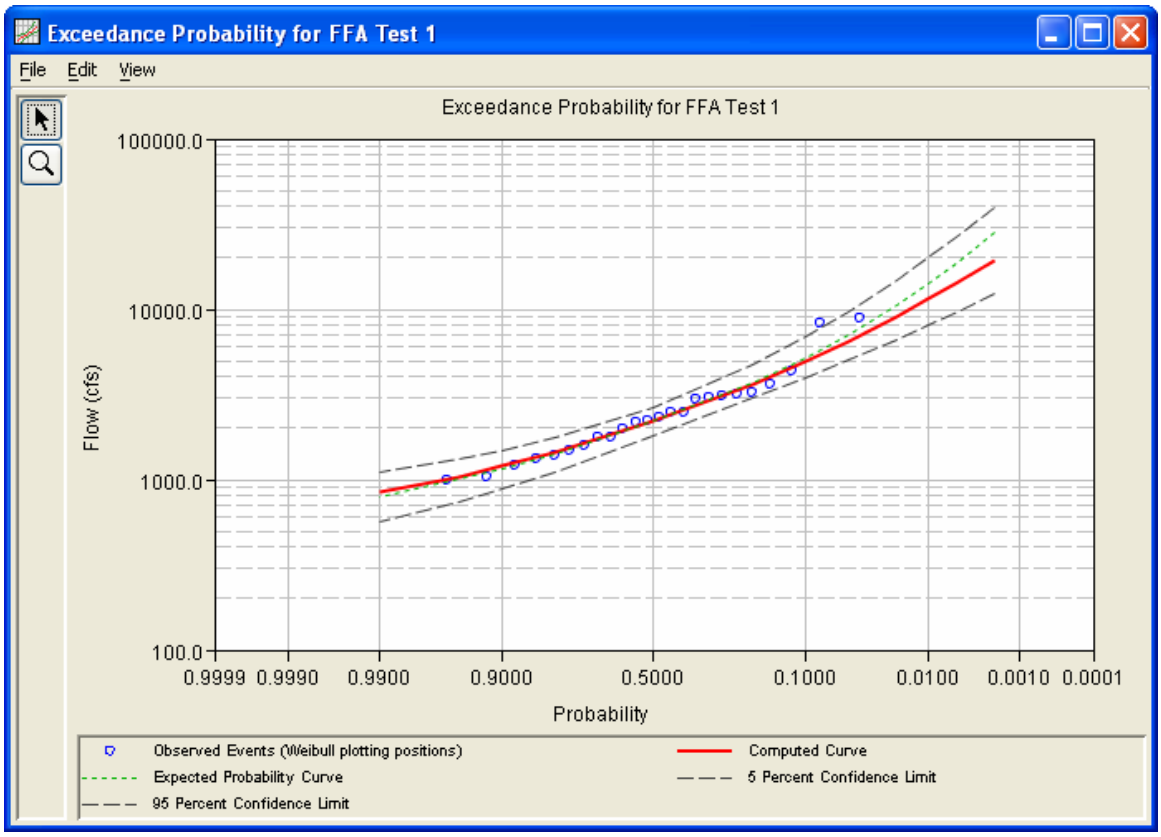


Figure B - 7. Plotted Frequency Curves for Test Example 1.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data files you want to send to the clipboard and then press the Control-C key sequence to send the data. To print the graphical results, first bring up the graphical plot, then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-8 is the report file for test example 1.

FFA_Test_1.rpt

File Edit Search Format

File: C:\HEC Data\SSP\FFA Tests\Bulletin17bResults\FFA_Test_1\FFA_Test_1.rpt

```
------------------------------
Bulletin 17B Frequency Analysis
    27 Apr 2006   09:26 AM
------------------------------


--- Input Data ---

Analysis Name: FFA Test 1
Description: WRC Appendix 12, Example 1 - Fitting the Log-Pearson Type III Distribution
Fishkill Creek at Beacon, NY

Data Set Name: FISHKILL CREEK-BEACON-FLOW
DSS File Name: C:\HEC Data\SSP\FFA Tests\FFA_Tests.dss
DSS Pathname: /FISHKILL CREEK/BEACON/FLOW/01jan1900/IR-CENTURY//

Report File Name: C:\HEC Data\SSP\FFA Tests\Bulletin17bResults\FFA_Test_1\FFA_Test_1.rpt
XML File Name: C:\HEC Data\SSP\FFA Tests\Bulletin17bResults\FFA_Test_1\FFA_Test_1.xml

Skew Option: Use Weighted Skew
Regional Skew: 0.6
Regional Skew MSE: 0.302
Round adopted skew to nearest tenth

Plotting Position Type: Weibull

Upper Confidence Level: 0.05
Lower Confidence Level: 0.95

Round ordinate values to 3 significant digits
Display ordinate values using 0 digits in fraction part of value

--- End of Input Data ---


--- Final Results ---

<< Plotting Positions >>
FISHKILL CREEK-BEACON-FLOW
-------------------------------------------------------------------
|     Events Analyzed      |          Ordered Events          |
|                    FLOW  |       Water       FLOW  Weibull  |
| Day Mon Year        cfs  |  Rank  Year        cfs  Plot Pos |
|--------------------------|----------------------------------|
|  05 Mar 1945      2,290  |    1   1955      8,800    4.00   |
|  27 Dec 1945      1,470  |    2   1956      8,280    8.00   |
|  14 Mar 1947      2,220  |    3   1961      4,340   12.00   |
|  18 Mar 1948      2,970  |    4   1968      3,630   16.00   |
|  01 Jan 1949      3,020  |    5   1953      3,220   20.00   |
|  09 Mar 1950      1,210  |    6   1952      3,170   24.00   |
|  01 Apr 1951      2,490  |    7   1962      3,060   28.00   |
|  12 Mar 1952      3,170  |    8   1949      3,020   32.00   |
|  25 Jan 1953      3,220  |    9   1948      2,970   36.00   |
|  13 Sep 1954      1,760  |   10   1958      2,500   40.00   |
```

123:65..123:65 123:65

Figure B - 8. Test Example 1 Report File.

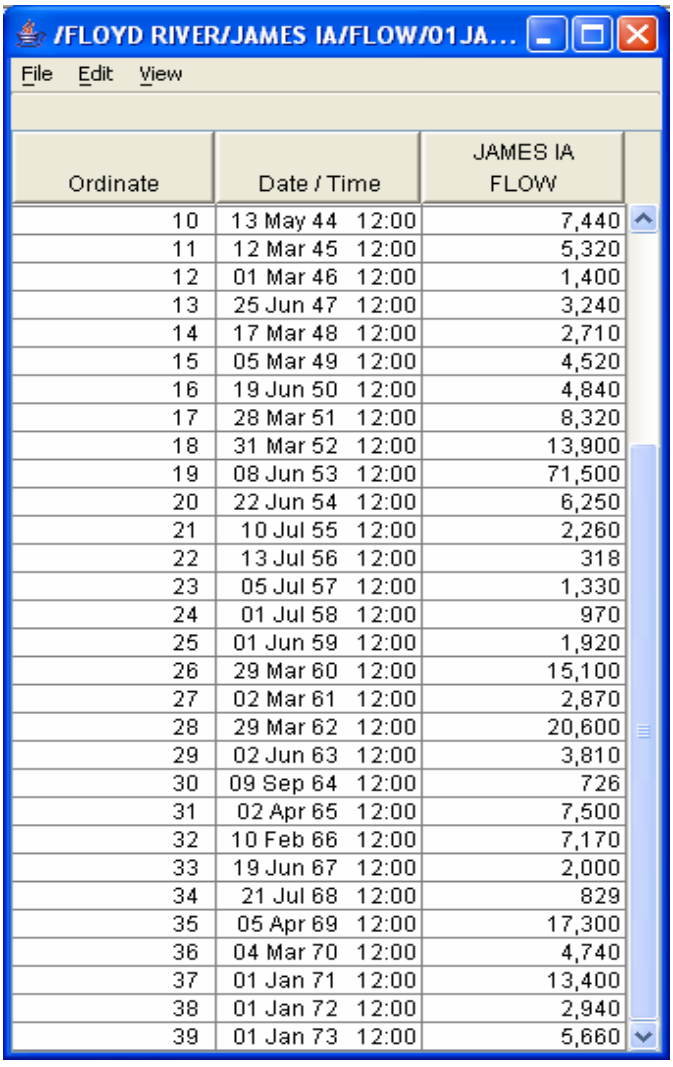
The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis. The user should

review the report file to understand how HEC-SSP performed the Bulletin 17B frequency curve calculations.

Example 2: Analysis with High Outliers

The input data for the HEC-SSP Example 2 is the same as that for Example 2 in Appendix 12, Guidelines for Determining Flood Flow Frequency, Water Resources Council Bulletin 17B, September 1981. Example 2 illustrates the application to data with a high outlier.

The data for this example is from Floyd River in James, Iowa. The period of record used is from 1935 to 1973. To view the data from HEC-SSP, right-click on the data record labeled "**FLOYD RIVER-JAMES IA-FLOW**" in the study pane, then select **Tabulate**. The data will appear as shown in Figure B-9.



Ordinate	Date / Time	JAMES IA FLOW
10	13 May 44 12:00	7,440
11	12 Mar 45 12:00	5,320
12	01 Mar 46 12:00	1,400
13	25 Jun 47 12:00	3,240
14	17 Mar 48 12:00	2,710
15	05 Mar 49 12:00	4,520
16	19 Jun 50 12:00	4,840
17	28 Mar 51 12:00	8,320
18	31 Mar 52 12:00	13,900
19	08 Jun 53 12:00	71,500
20	22 Jun 54 12:00	6,250
21	10 Jul 55 12:00	2,260
22	13 Jul 56 12:00	318
23	05 Jul 57 12:00	1,330
24	01 Jul 58 12:00	970
25	01 Jun 59 12:00	1,920
26	29 Mar 60 12:00	15,100
27	02 Mar 61 12:00	2,870
28	29 Mar 62 12:00	20,600
29	02 Jun 63 12:00	3,810
30	09 Sep 64 12:00	726
31	02 Apr 65 12:00	7,500
32	10 Feb 66 12:00	7,170
33	19 Jun 67 12:00	2,000
34	21 Jul 68 12:00	829
35	05 Apr 69 12:00	17,300
36	04 Mar 70 12:00	4,740
37	01 Jan 71 12:00	13,400
38	01 Jan 72 12:00	2,940
39	01 Jan 73 12:00	5,660

Figure B - 9. HEC-SSP Tabulation of the Peak Flow Data for the Floyd River.

To plot the data for this example, right-click on the data record again, then select **Plot**. A plot of the data will appear as shown in Figure B-10.

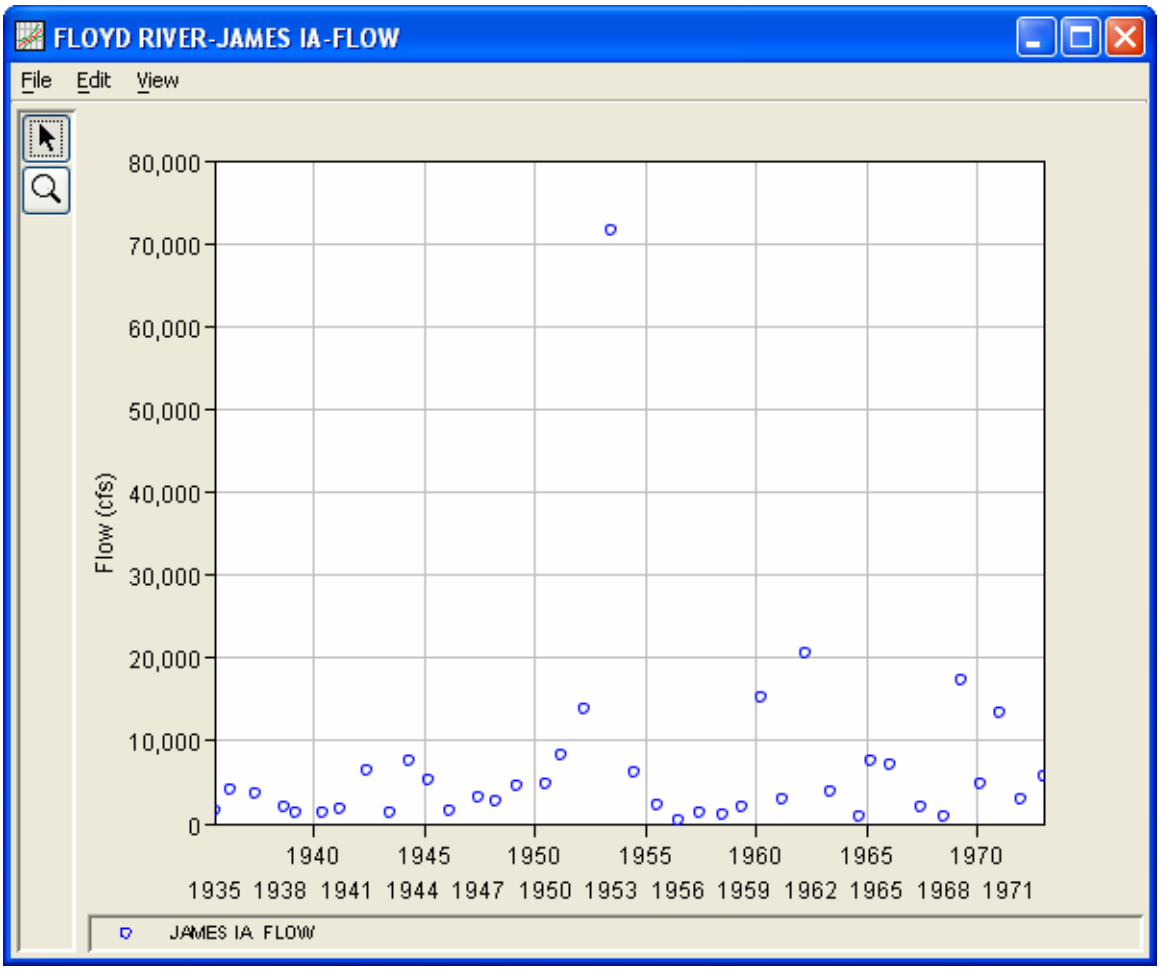


Figure B - 10. HEC-SSP Plot of Floyd River Data

A Bulletin 17B analysis set has been developed for each of the test examples. To open the Bulletin 17B analysis editor for test example 2, either double-click on the analysis labeled **FFA Test 2** from the study pane, or from the **Analysis** menu select open, then select **FFA Test 2** from the list of available analyses. When FFA Test 2 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-11.

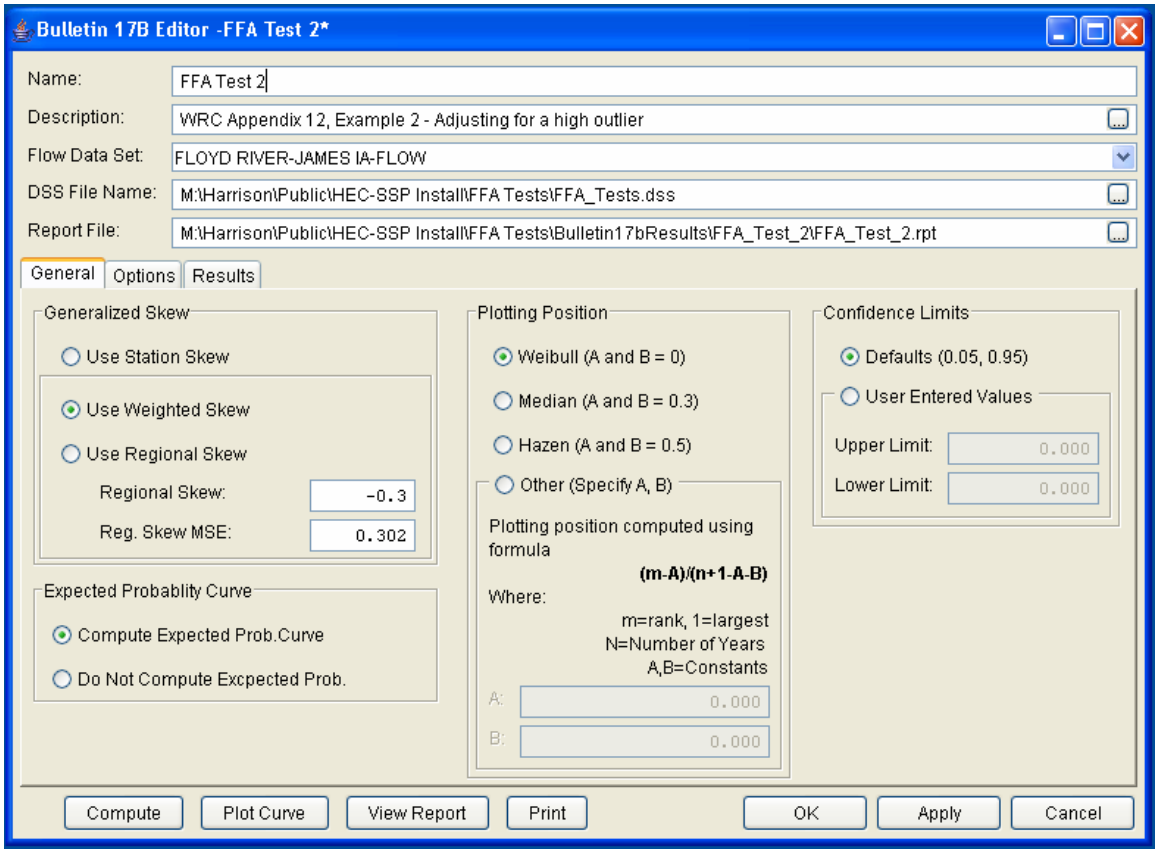


Figure B - 11. Bulletin 17B Analysis Editor with Test Example 2 Data Set.

Shown in Figure B-11 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of -0.3 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve.

The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance).

Shown in Figure B-12 is the Bulletin 17B editor with the **Options Tab** selected.

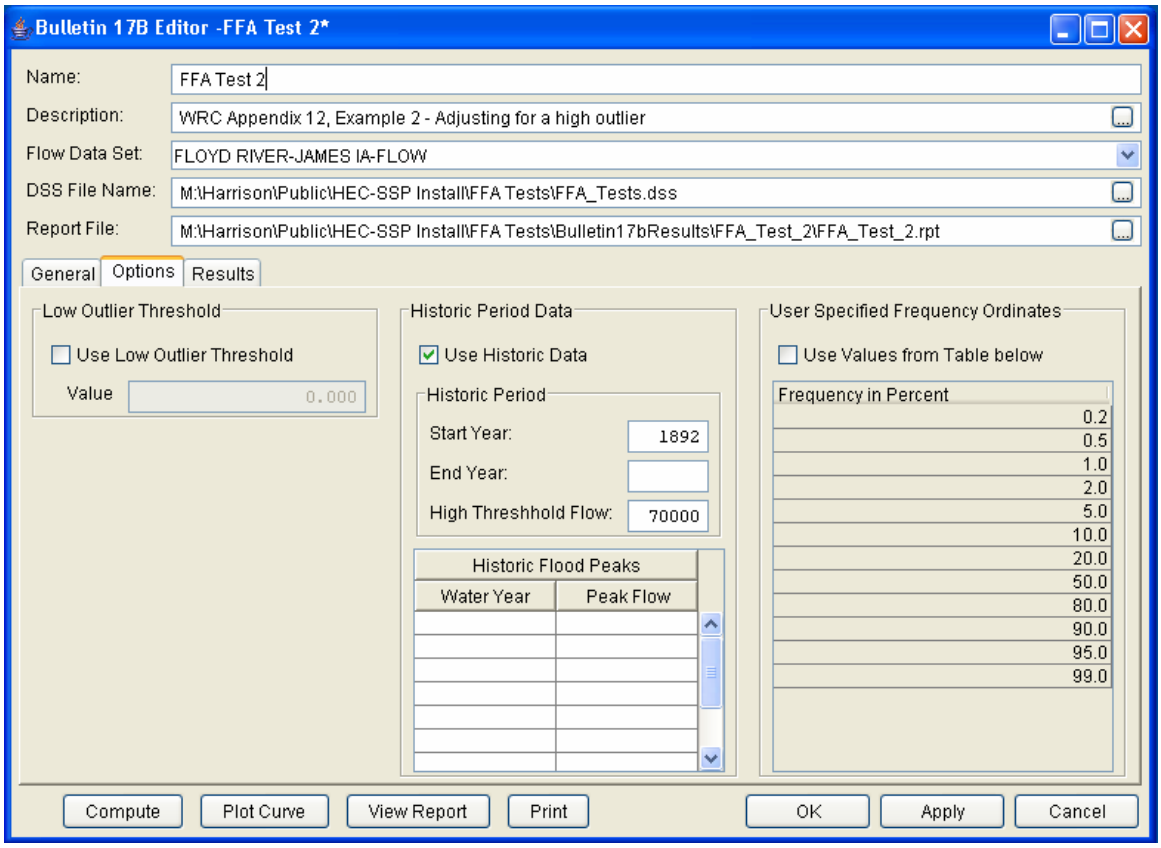


Figure B - 12. Bulletin 17B Editor with Options Tab Selected.

As shown in Figure B-12, the **Historic Period Data** option has been selected to reflect that the 1953 flood peak of 71,500 cfs is known to be the largest flood since 1892. When the analysis was originally performed on this data set, the 1953 event was found to be a high outlier. (The reader may replicate this result by unchecking the "Use Historic Data" box, hitting the Compute button, and reviewing the Results tab.) High outliers should not be eliminated from an analysis, as they are valuable pieces of the flow record. However, when a high outlier is found in a data set, it suggests that the event might actually be the largest in a much longer period of record. The analyst should always try to locate and incorporate historic information to define a longer record and improve the quality of the frequency analysis. Since it was known that the 1953 event was the largest value since 1892, the year 1892 is entered as the **Start Year** for the historic period. Additionally a **High Threshold Value** of 70,000 cfs was entered. By entering the High Threshold Value of 70,000 cfs, the 1953 flood of 71,500 cfs was removed from the systematic record and treated as a historic data value during the historic data adjustment calculations performed by HEC-SSP and outlined in Bulletin 17B Appendix 6. Since no End Year was entered for the historic period, the last year of the systematic data set will be used as the End Year.

Other features in this tab include using the **Low Outlier Threshold** and the option to override the default **Frequency Ordinates,** neither of which are selected in this example.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the computations. If the data has been entered correctly, once the computations have been completed a message window will pop up and say **Compute Completed.** Close this window and then select the **Results Tab** from the analysis window. The analysis window should look like Figure B-13.

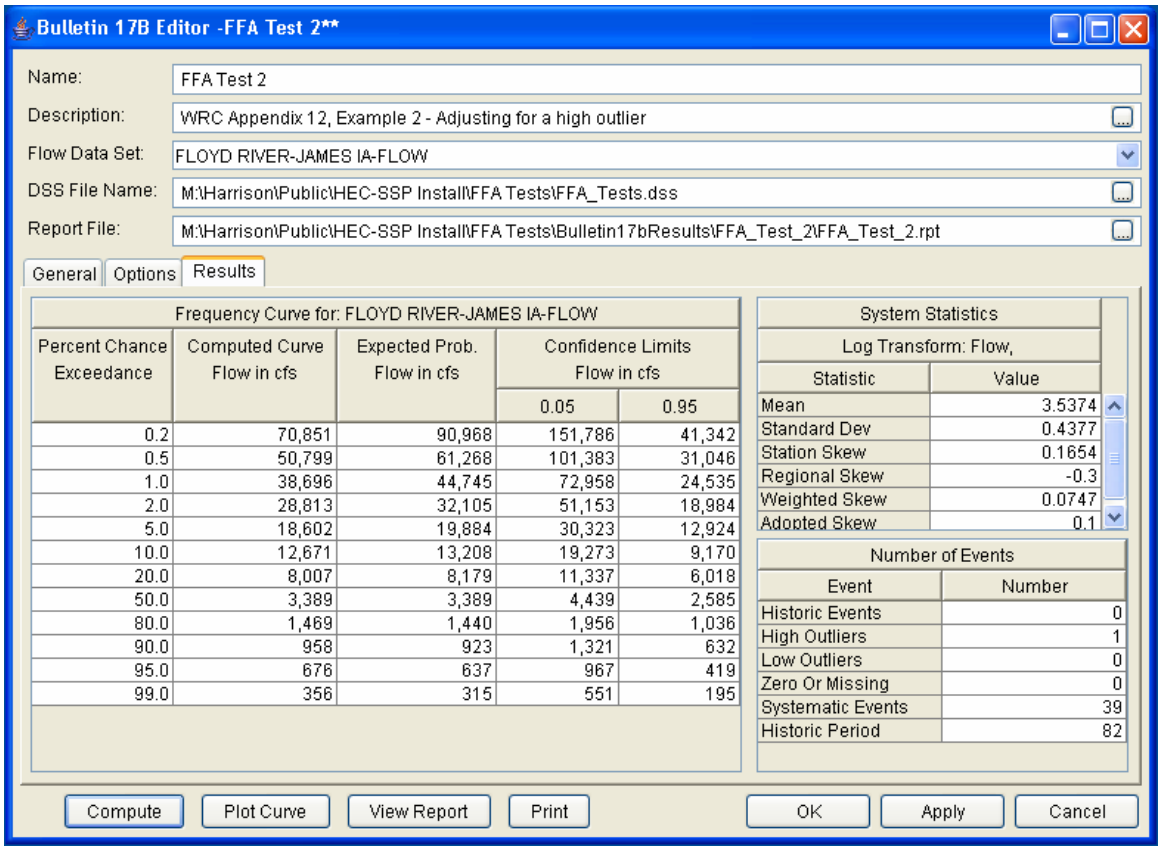


Figure B - 13. Bulletin 17B Editor with Results Tab Selected.

As shown in Figure B-13, the left table on the results tab contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the right-hand side of the results tab is a table of statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the right-hand side of the results tab is a table showing: the number of historic events used in the analysis; number of high outliers found; number of low outliers; number of zero or missing data years; number of systematic events in the gage record; and the historic record length (if historic data was entered).

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-14.

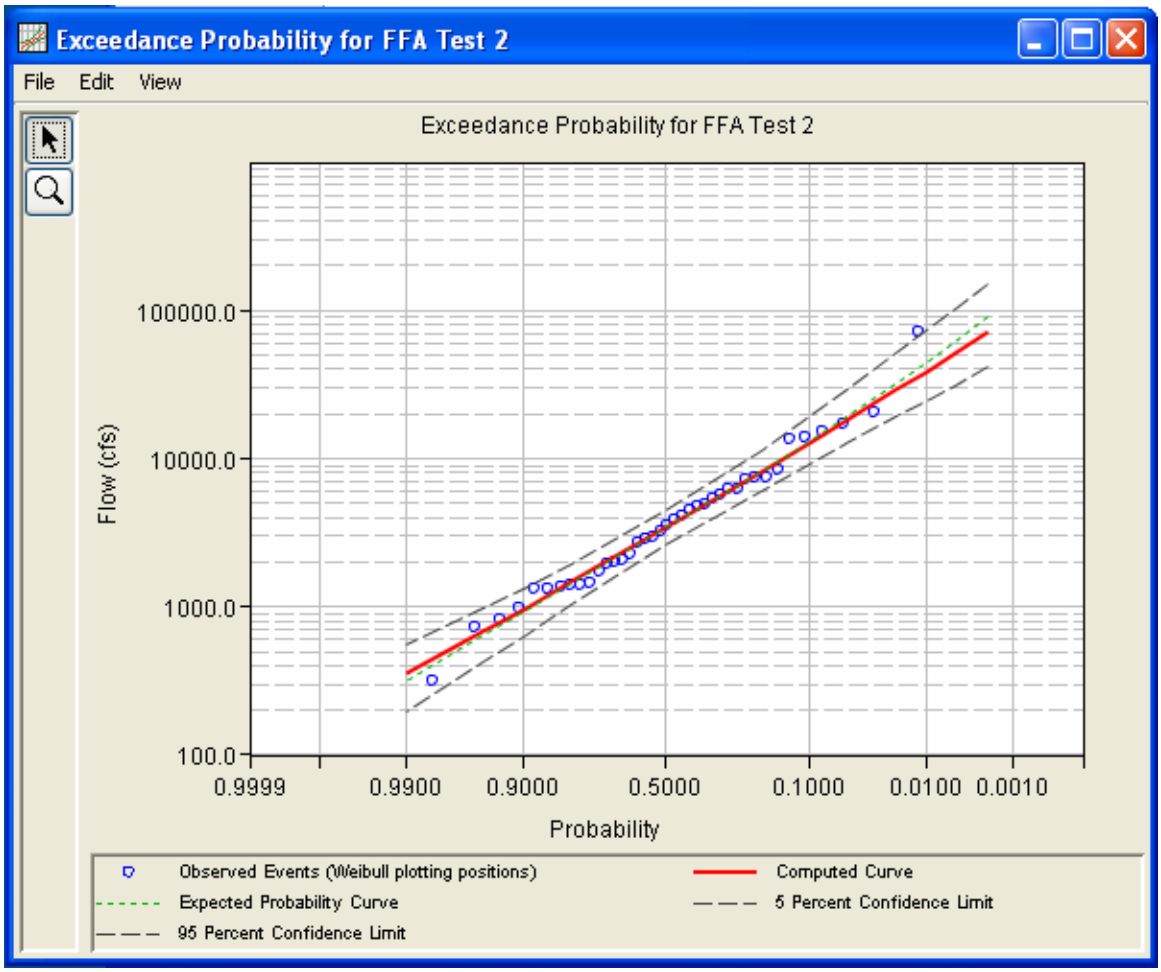


Figure B - 14. Plotted Frequency Curves for Test Example 2.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data files you want to send to the clipboard and then press the Control-C key sequence to send the data. To print the graphical results, first bring up the graphical plot, then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-15 is the report file for test example 2.

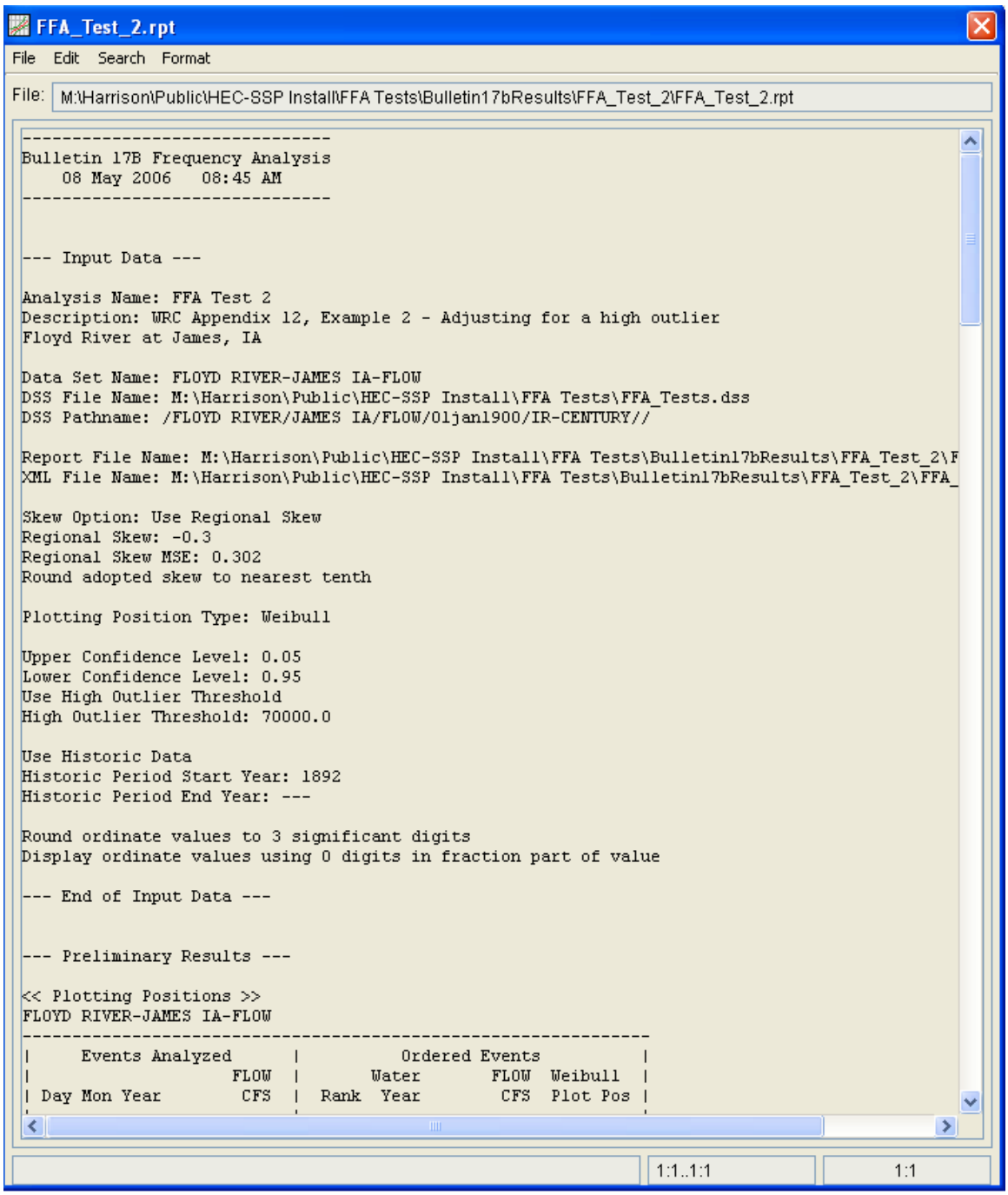


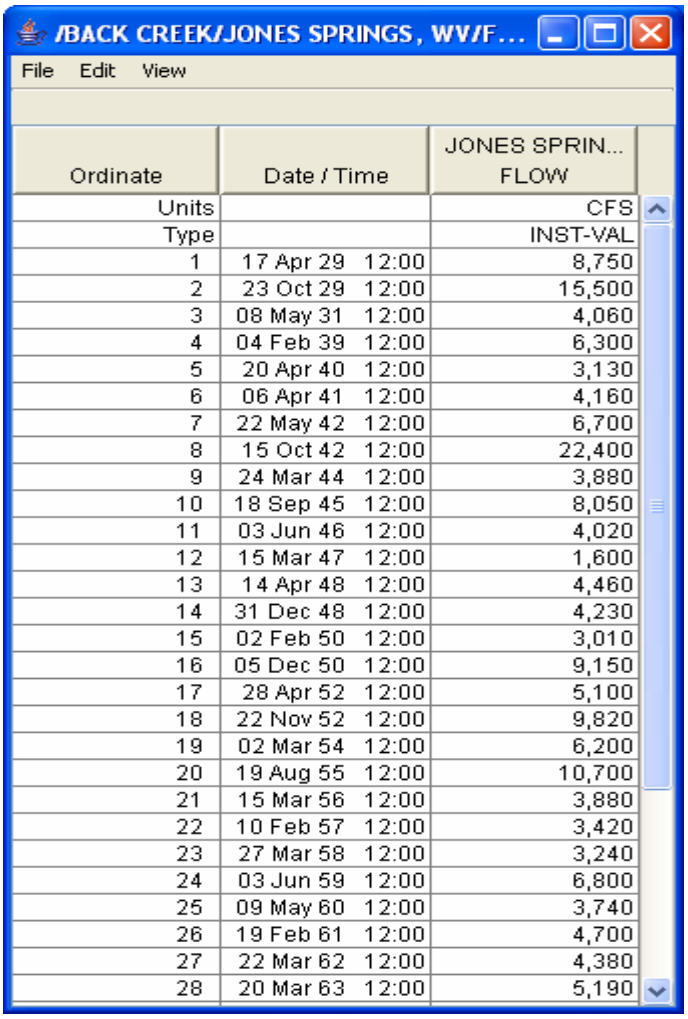
Figure B - 15. Test Example 2 Report File.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis. The user should review the report file to understand how HEC-SSP performed the Bulletin 17B frequency curve calculations.

Example 3: Testing and Adjusting for a Low Outlier

The input data for Test 3 are the same as that for Example 3 in Appendix 12 of the WRC Guidelines. Test 3 illustrates the application to data with a low outlier. Note that the program automatically screens for low outliers and, if low outliers are found, outputs the preliminary results in the report file in order to allow for comparison with the final results.

The data for this example is from Back Creek in Jones Springs, West Virginia. The period of record used for this example is from 1929 to 1973. To view the data from HEC-SSP, right-click on the data record labeled "**BACK CREEK-JONES SPRINGS, WV-FLOW**" in the study pane, then select **Tabulate**. The data will appear as shown in Figure B-16.



Ordinate	Date / Time	JONES SPRIN... FLOW
Units		CFS
Type		INST-VAL
1	17 Apr 29 12:00	8,750
2	23 Oct 29 12:00	15,500
3	08 May 31 12:00	4,060
4	04 Feb 39 12:00	6,300
5	20 Apr 40 12:00	3,130
6	06 Apr 41 12:00	4,160
7	22 May 42 12:00	6,700
8	15 Oct 42 12:00	22,400
9	24 Mar 44 12:00	3,880
10	18 Sep 45 12:00	8,050
11	03 Jun 46 12:00	4,020
12	15 Mar 47 12:00	1,600
13	14 Apr 48 12:00	4,460
14	31 Dec 48 12:00	4,230
15	02 Feb 50 12:00	3,010
16	05 Dec 50 12:00	9,150
17	28 Apr 52 12:00	5,100
18	22 Nov 52 12:00	9,820
19	02 Mar 54 12:00	6,200
20	19 Aug 55 12:00	10,700
21	15 Mar 56 12:00	3,880
22	10 Feb 57 12:00	3,420
23	27 Mar 58 12:00	3,240
24	03 Jun 59 12:00	6,800
25	09 May 60 12:00	3,740
26	19 Feb 61 12:00	4,700
27	22 Mar 62 12:00	4,380
28	20 Mar 63 12:00	5,190

Figure B - 16. HEC-SSP Tabulation of the Peak Flow Data for Back Creek.

To plot the data for this example, right-click on the data record again, then select **Plot**. A plot of the data will appear as shown in Figure B-17.

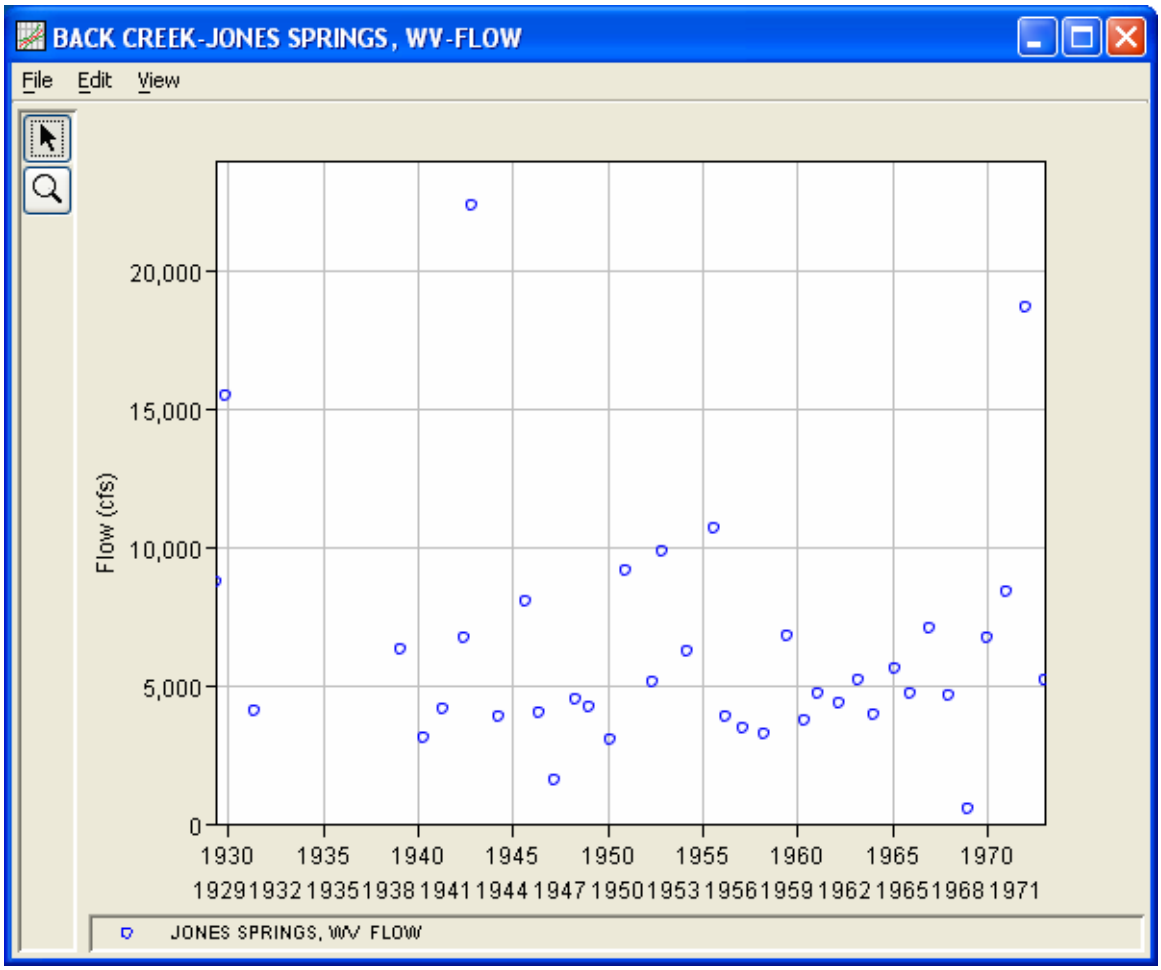


Figure B - 17. HEC-SSP Plot of Back Creek Data.

A Bulletin 17B analysis set has been developed for each of the test examples. To open the Bulletin 17B analysis editor for test example 3, either double-click on the analysis labeled **FFA Test 3** from the study pane, or from the **Analysis** menu select open, then select **FFA Test 3** from the list of available analyses. When FFA Test 3 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-18.

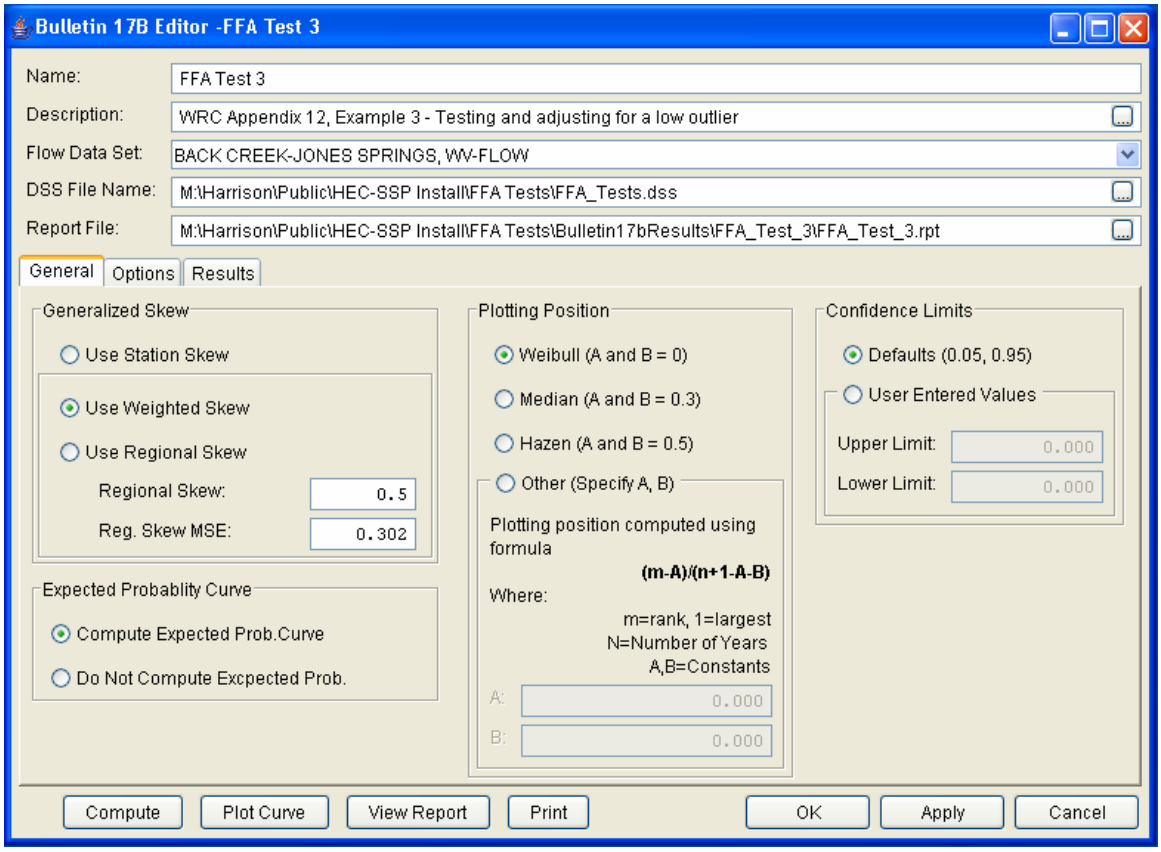


Figure B - 18. Bulletin 17B Analysis Editor with Test Example 3 Data Set.

Shown in Figure B-18 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example, a value of 0.5 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve.

The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance).

Shown in Figure B-19 is the Bulletin 17B editor with the **Options Tab** selected.

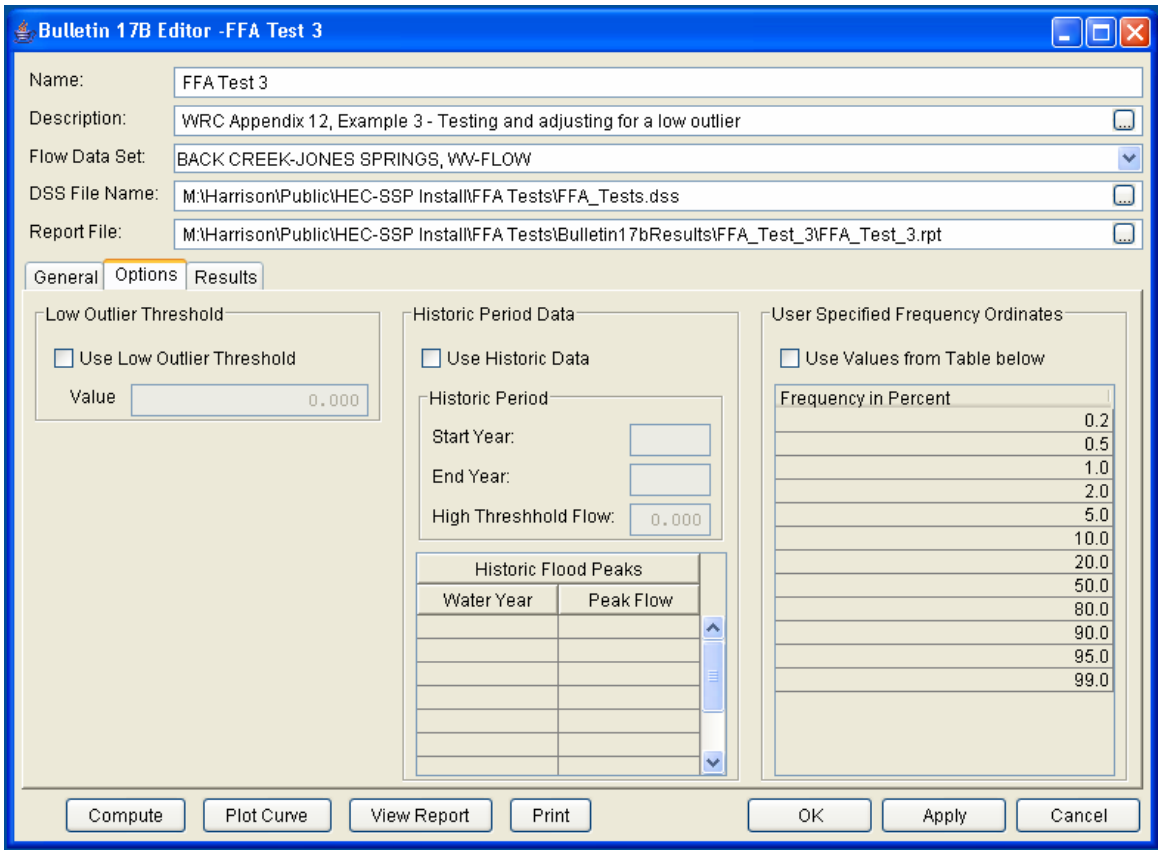


Figure B - 19. Bulletin 17B Editor with the Options Tab Selected.

As shown in Figure B-19, none of the available options for modifying the frequency curve were selected for this test example. These options include using the **Low Outlier Threshold** and **Historic Period Data**. Additionally, the option to override the default **Frequency Ordinates** was not selected.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the computations. If the data has been entered correctly, once the computations have been completed a message window will pop up and say **Compute Completed.** Close this window and then select the **Results Tab** from the analysis window. The analysis window should look like Figure B-20.

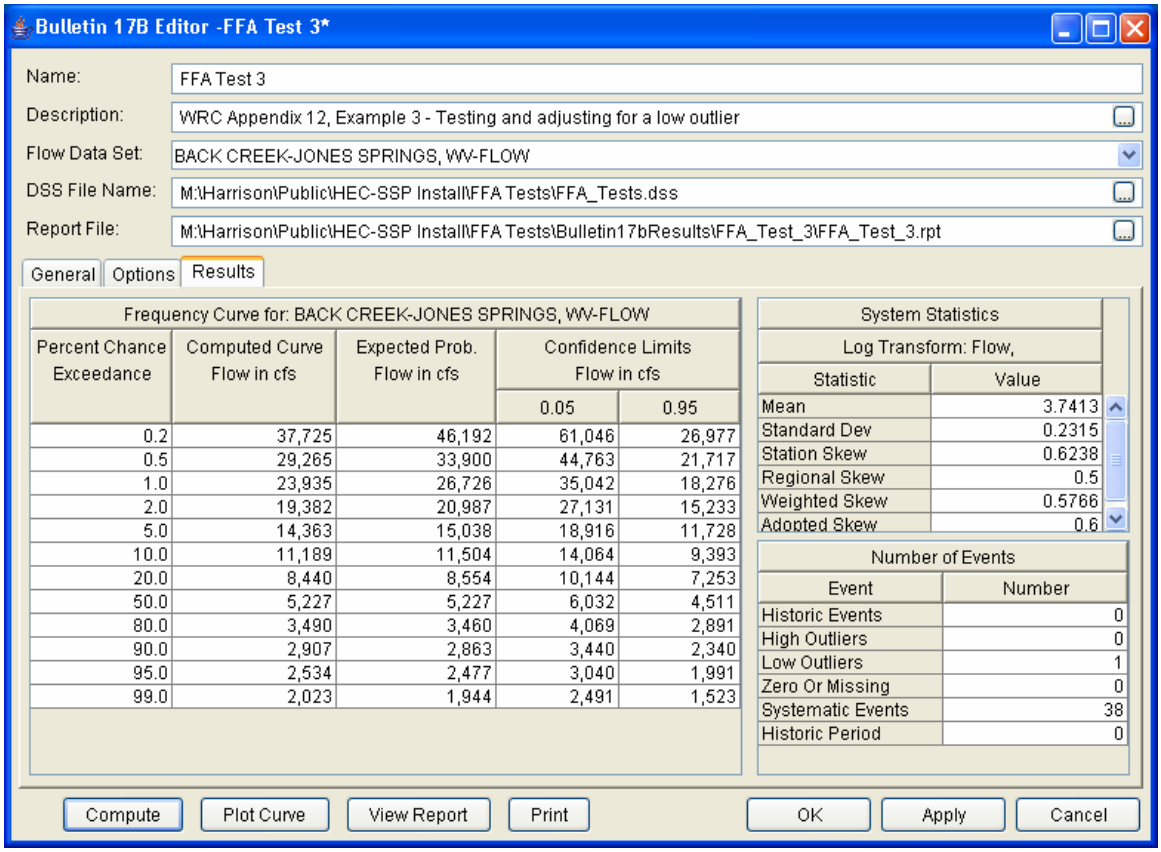


Figure B - 20. Bulletin 17B Editor with the Results Tab Selected for Test Example 3.

As shown in Figure B-20, the left table on the results tab contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the right-hand side of the results tab is a table of statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the right-hand side of the results tab is a table showing: the number of historic events used in the analysis; number of high outliers found; number of low outliers; number of zero or missing data years; number of systematic events in the gage record; and the historic record length (if historic data was entered).

In this analysis, the software detected 1 low outlier in the systematic record. As recommended in Bulletin 17B in the presence of a low outlier, that data point was removed and the Conditional Probability Adjustment was used to recalculate the frequency curve and then the statistics without that point. To see the original statistics, computed curves, the low outlier test, and recomputed curves, review the report file as shown below.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-21.

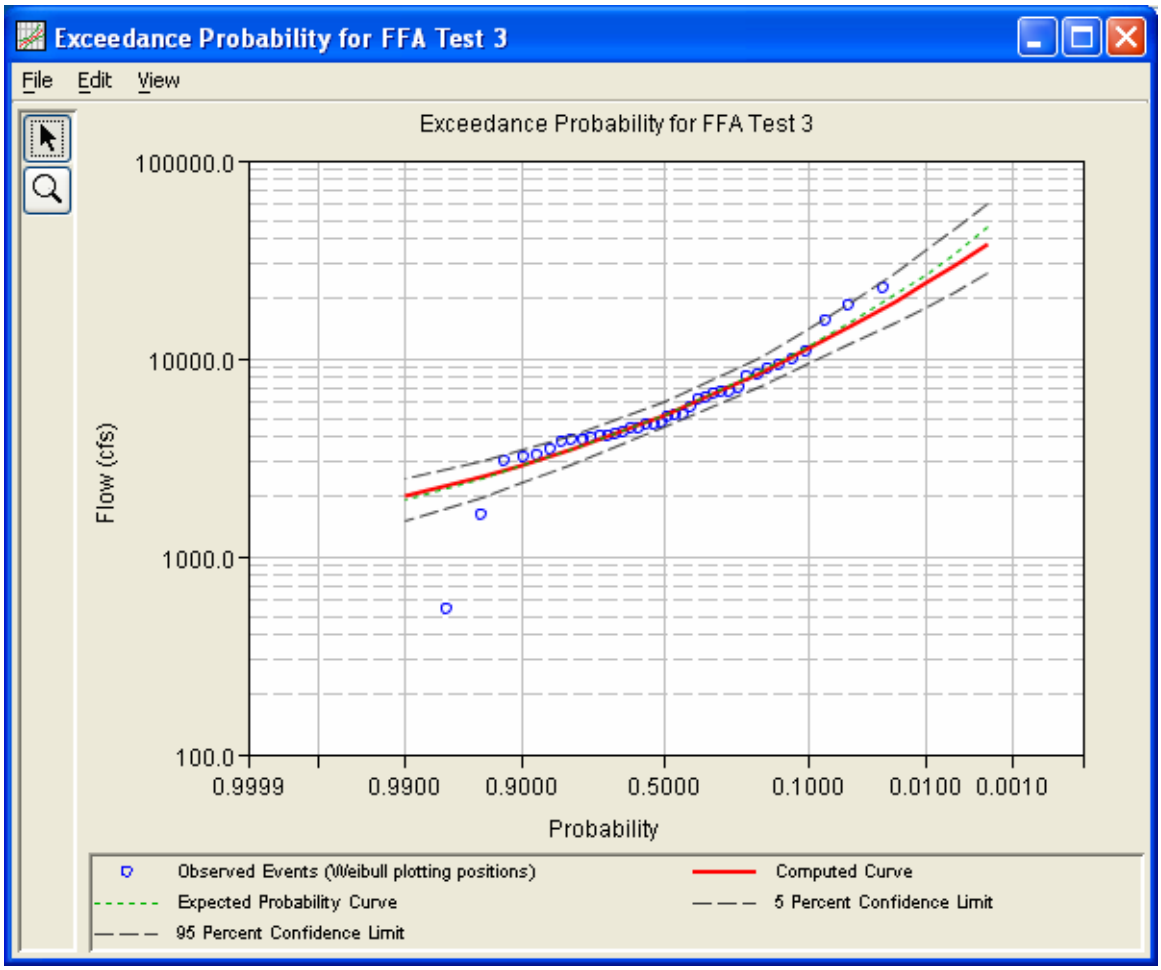


Figure B - 21. Example HEC-SSP Frequency Curve PLot for Test Example 3.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-22 is the report file for test example 3.

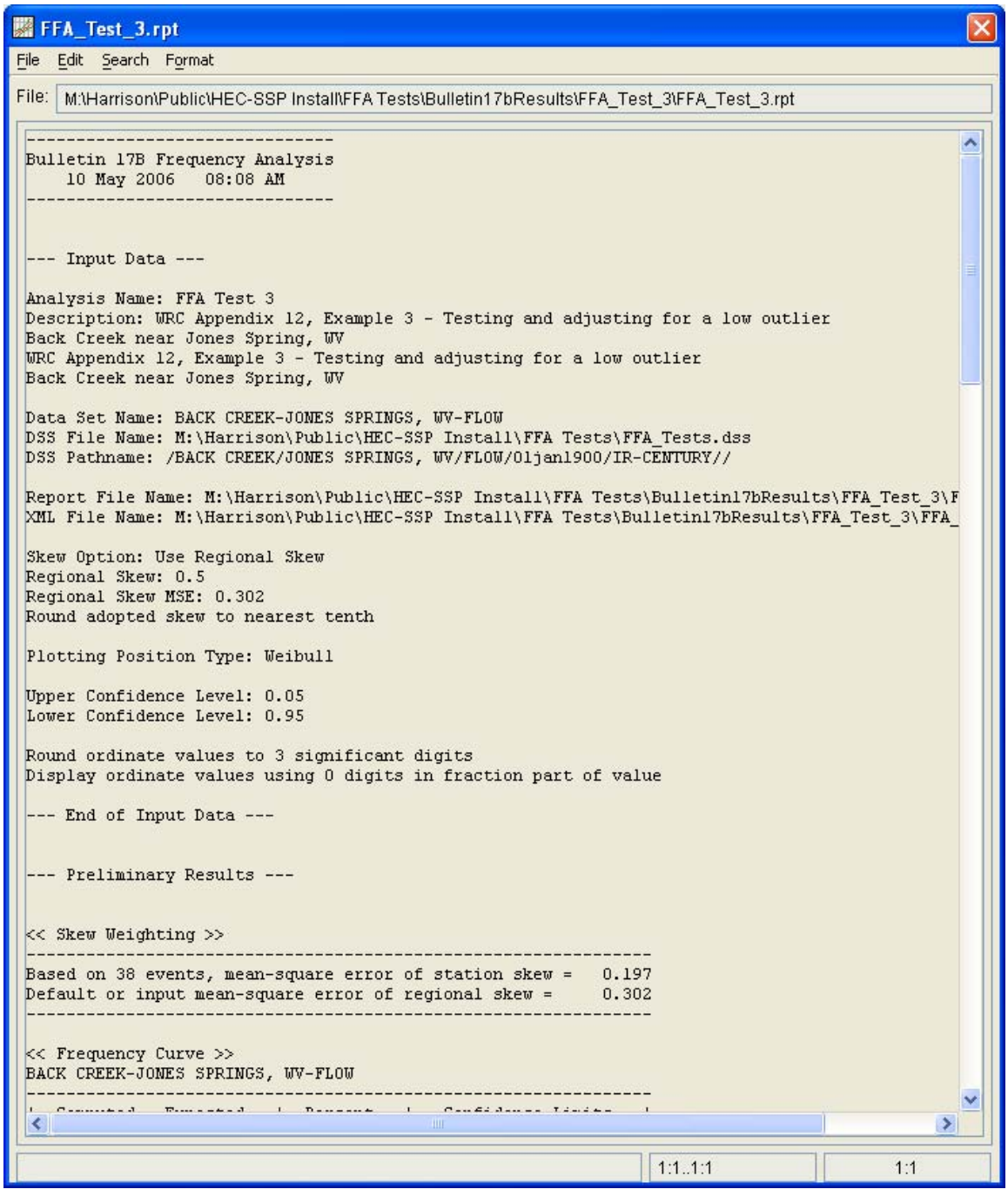


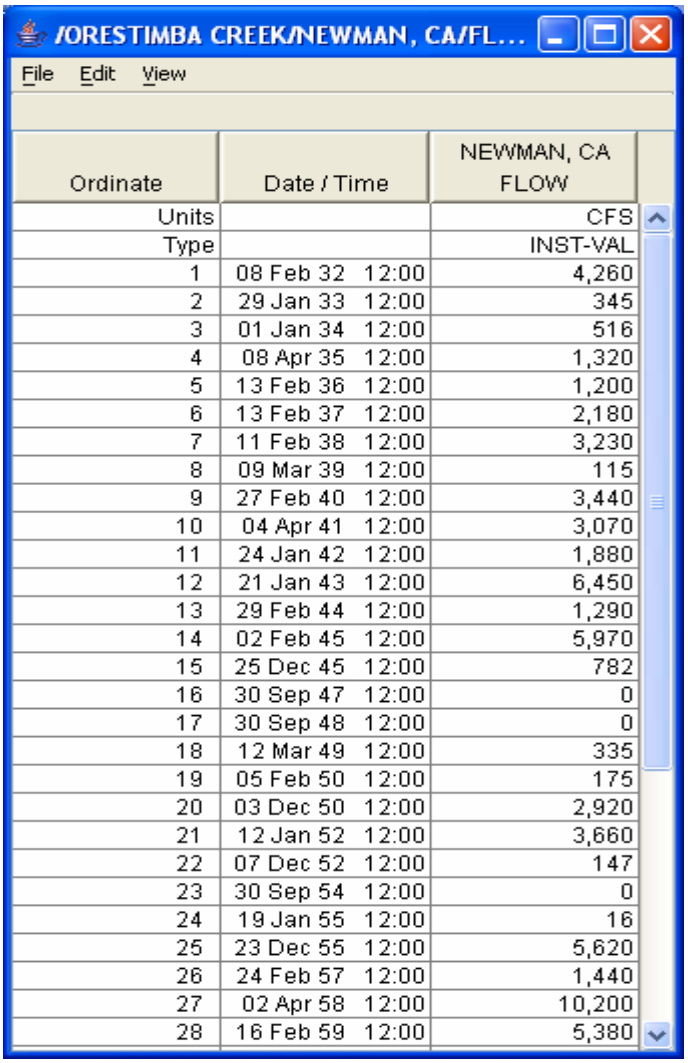
Figure B - 22. HEC-SSP Report File for Test Example 3.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

Example 4: Zero-Flood Years

The input data for Test 4 are the same as that for Example 4 in Appendix 12 of the WRC Guidelines. Test 4 illustrates the application to data that includes several zero flow years.

The data for this example is from Orestimba Creek in Newman, California. The period of record used for this example is from 1932 to 1973. To view the data from HEC-SSP, right-click on the data record labeled "**ORESTIMBA CREEK-NEWMAN, CA-FLOW**" in the study pane, then select **Tabulate**. The data will appear as shown in Figure B-23.


/ORESTIMBA CREEK/NEWMAN, CA/FL...

File Edit View

Ordinate	Date / Time	NEWMAN, CA FLOW
Units		CFS
Type		INST-VAL
1	08 Feb 32 12:00	4,260
2	29 Jan 33 12:00	345
3	01 Jan 34 12:00	516
4	08 Apr 35 12:00	1,320
5	13 Feb 36 12:00	1,200
6	13 Feb 37 12:00	2,180
7	11 Feb 38 12:00	3,230
8	09 Mar 39 12:00	115
9	27 Feb 40 12:00	3,440
10	04 Apr 41 12:00	3,070
11	24 Jan 42 12:00	1,880
12	21 Jan 43 12:00	6,450
13	29 Feb 44 12:00	1,290
14	02 Feb 45 12:00	5,970
15	25 Dec 45 12:00	782
16	30 Sep 47 12:00	0
17	30 Sep 48 12:00	0
18	12 Mar 49 12:00	335
19	05 Feb 50 12:00	175
20	03 Dec 50 12:00	2,920
21	12 Jan 52 12:00	3,660
22	07 Dec 52 12:00	147
23	30 Sep 54 12:00	0
24	19 Jan 55 12:00	16
25	23 Dec 55 12:00	5,620
26	24 Feb 57 12:00	1,440
27	02 Apr 58 12:00	10,200
28	16 Feb 59 12:00	5,380

Figure B - 23. HEC-SSP Tabulation of the Peak Flow Data for Orestimba Creek.

To plot the data for this example, right-click on the data record again, then select **Plot**. A plot of the data will appear as shown in Figure B-24. The years with peak flows measuring zero are visible.

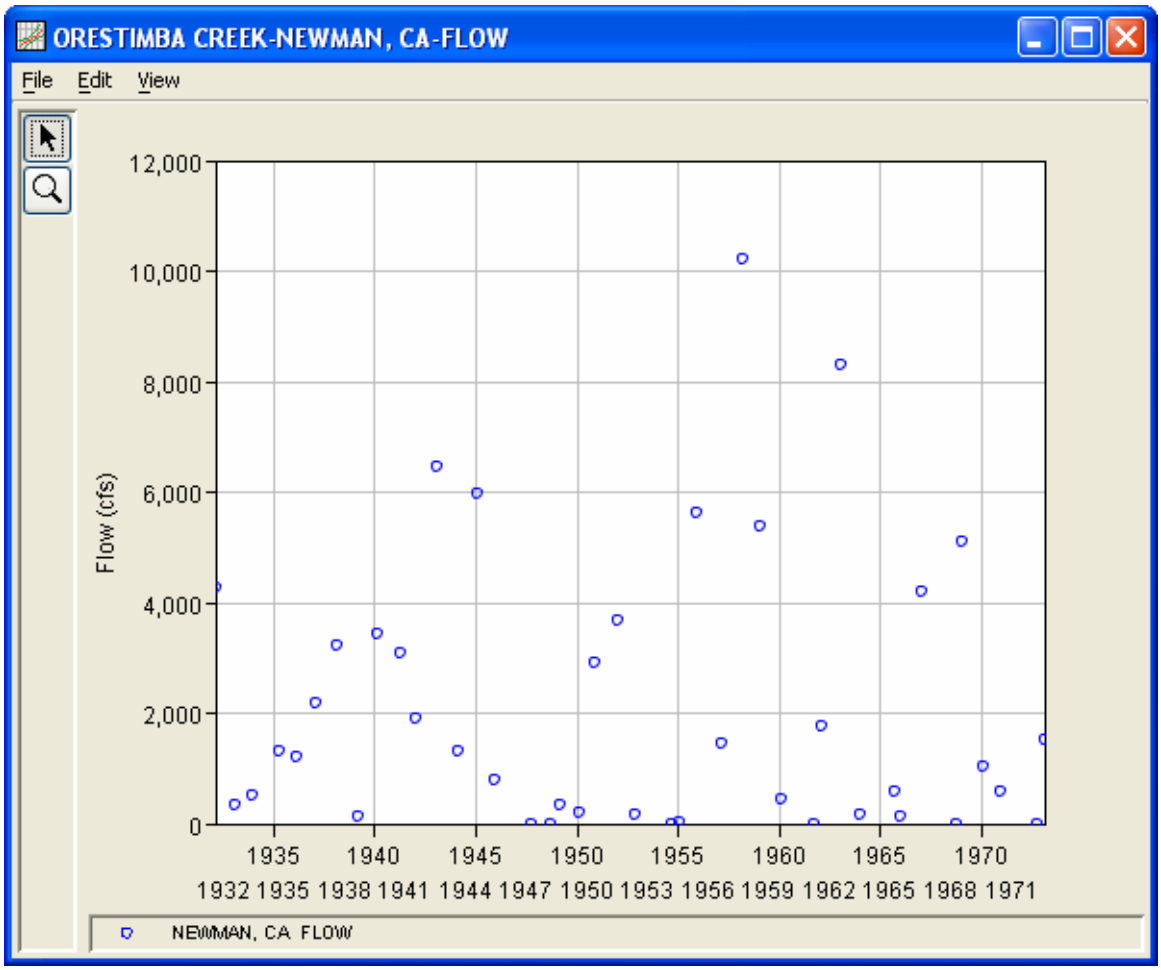


Figure B - 24. HEC-SSP Plot of Orestimba Creek Data.

A Bulletin 17B analysis set has been developed for each of the test examples. To open the Bulletin 17B analysis editor for test example 4, either double-click on the analysis labeled **FFA Test 4** from the study pane, or from the **Analysis** menu select open, then select **FFA Test 4** from the list of available analyses. When FFA Test 4 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-25.

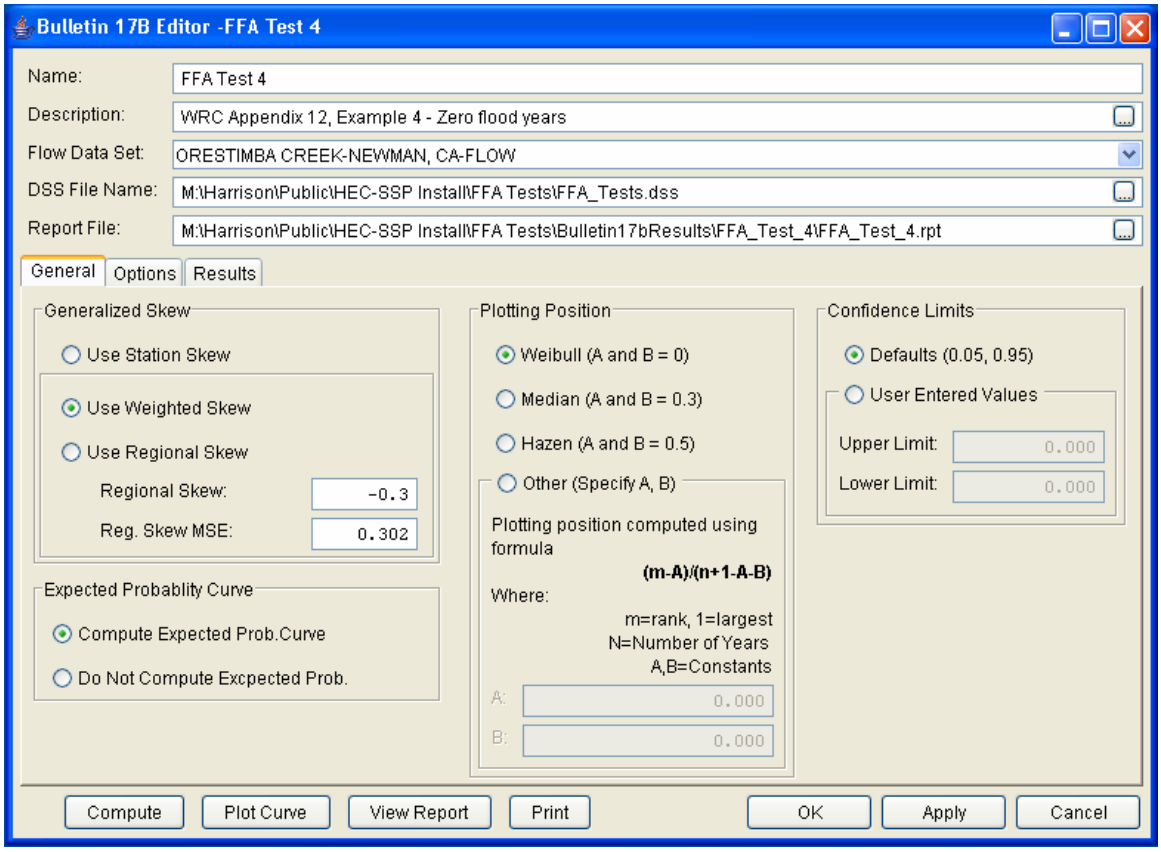


Figure B - 25. Bulletin 17B Analysis Editor with Test Example 4 Data Set.

Shown in Figure B-25 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of -0.3 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve.

The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance).

Shown in Figure B-26 is the Bulletin 17B editor with the **Options Tab** selected.

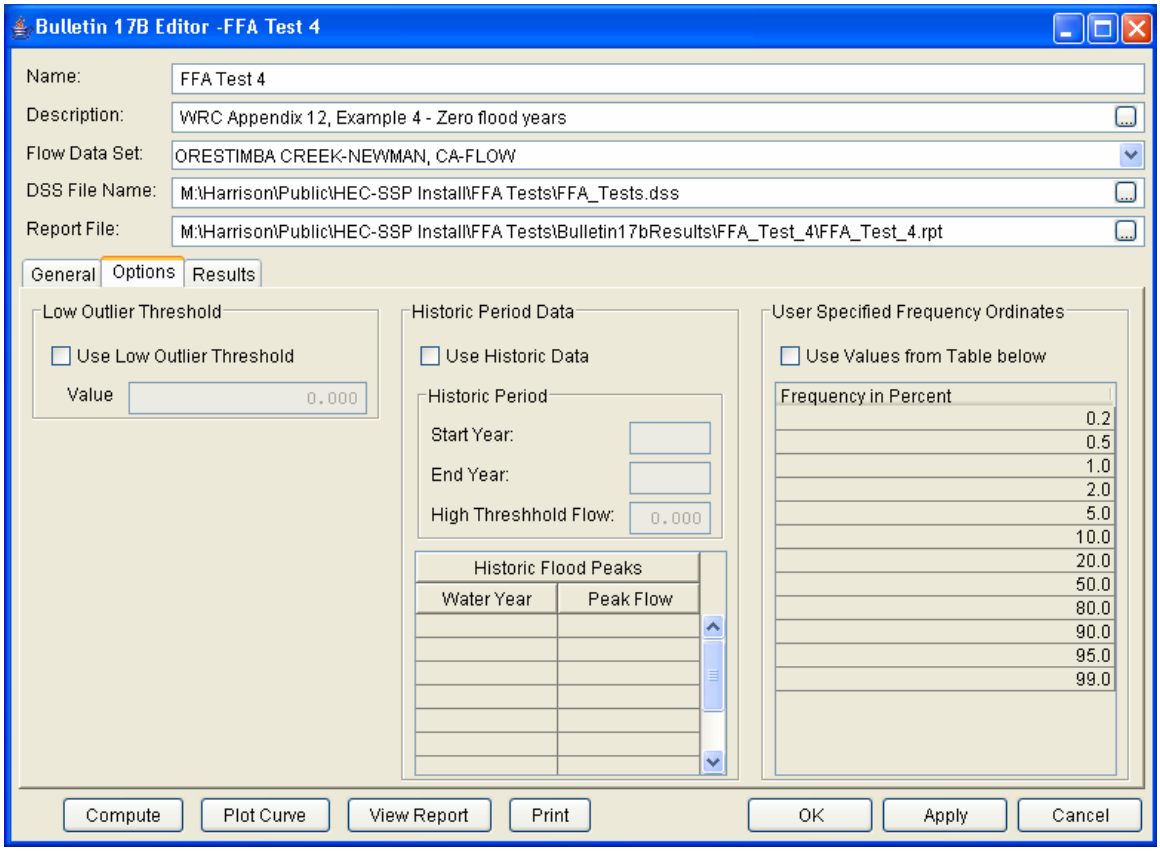


Figure B - 26. Bulletin 17B Editor with the Options Tab Selected.

As shown in Figure B-26, none of the available options for modifying the frequency curve were selected for this test example. These options include using the **Low Outlier Threshold** and **Historic Period Data**. Additionally, the option to override the default **Frequency Ordinates** was not selected.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the computations. If the data has been entered correctly, once the computations have been completed a message window will pop up and say **Compute Completed.** Close this window and then select the **Results Tab** from the analysis window. The analysis window should look Figure B-27.

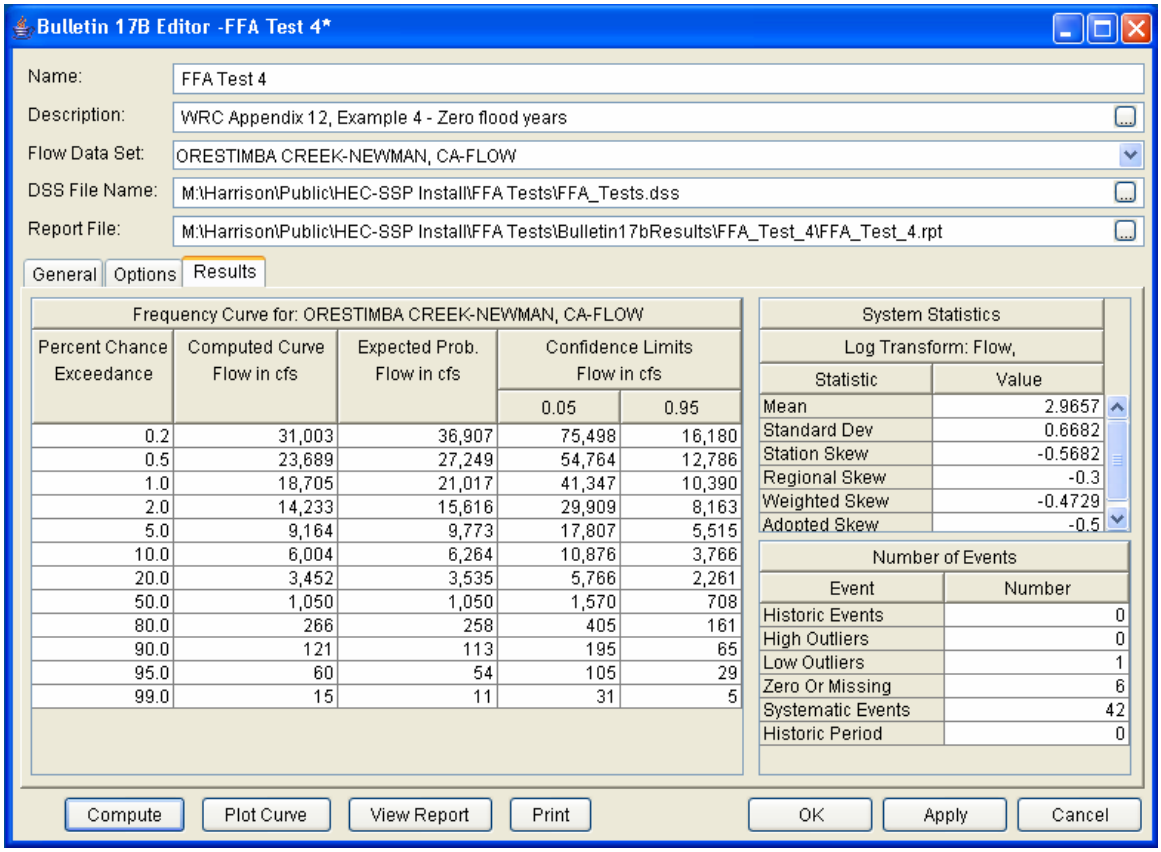


Figure B - 27. Bulletin 17B Editor with the Results Tab Selected for Test Example 4.

As shown in Figure B-27, the left table on the results tab contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the right-hand side of the results tab is a table of statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the right-hand side of the results tab is a table showing: the number of historic events used in the analysis; number of high outliers found; number of low outliers; number of zero or missing data years; number of systematic events in the gage record; and the historic record length (if historic data was entered).

As noted earlier, there were 6 zero values in this record, and also a low outlier. A zero value causes difficulty because the first step in fitting a Log Pearson III distribution is computing the base-10 log of each flow value, which is undefined for zero. Bulletin 17B recommends removing the zero values (and the low outlier) from the systematic record to compute a preliminary frequency curve, and then adjusting that curve with the Conditional Probability Adjustment. The final frequency curve and statistics are shown in the table, and the preliminary calculations can be reviewed in the report file as shown below.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-28.

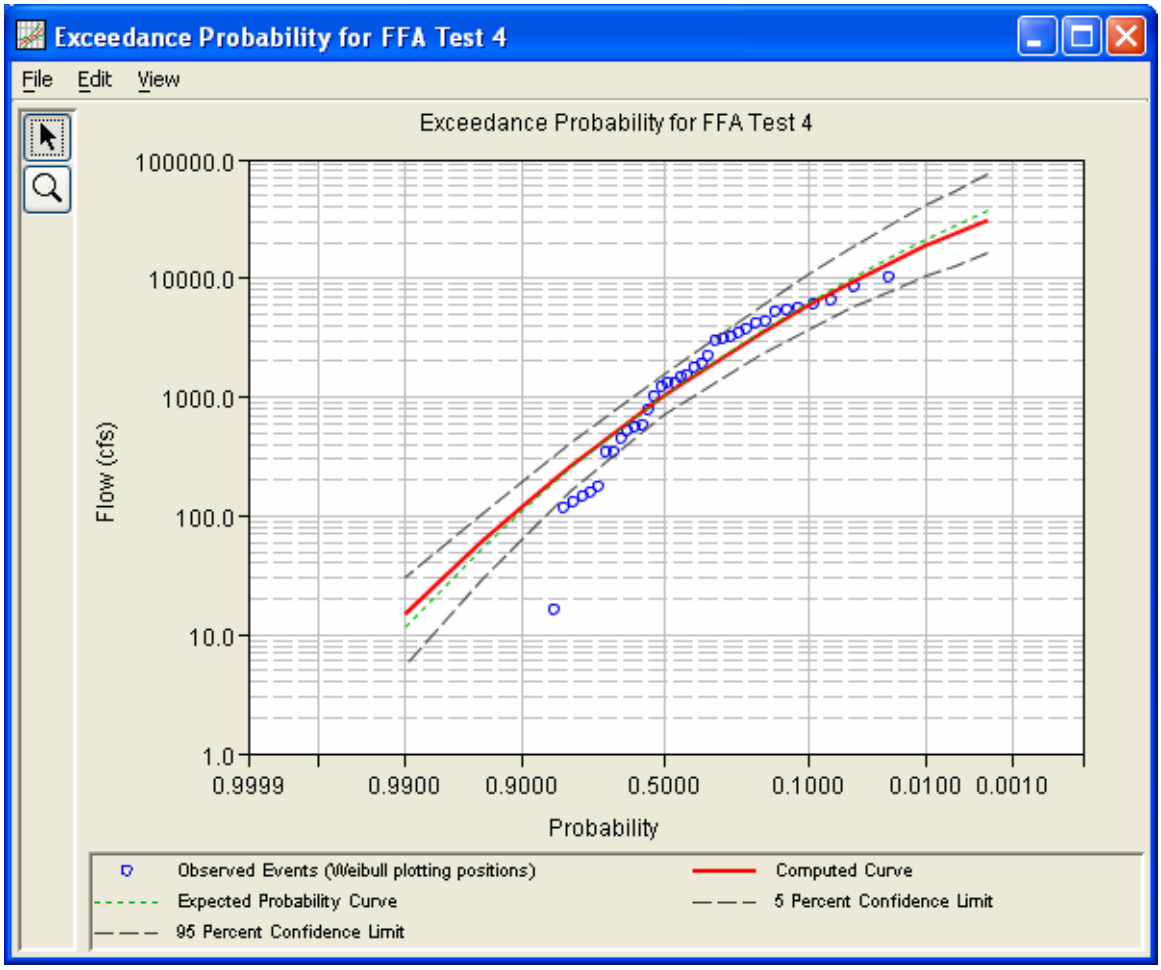


Figure B - 28. HEC-SSP Plot of Test Example 4 Results.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard,

highlight the data files you want to send to the clipboard and then press the Control-C key sequence to send the data. To print the graphical results, first bring up the graphical plot, then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-29 is the report file for test example 4.

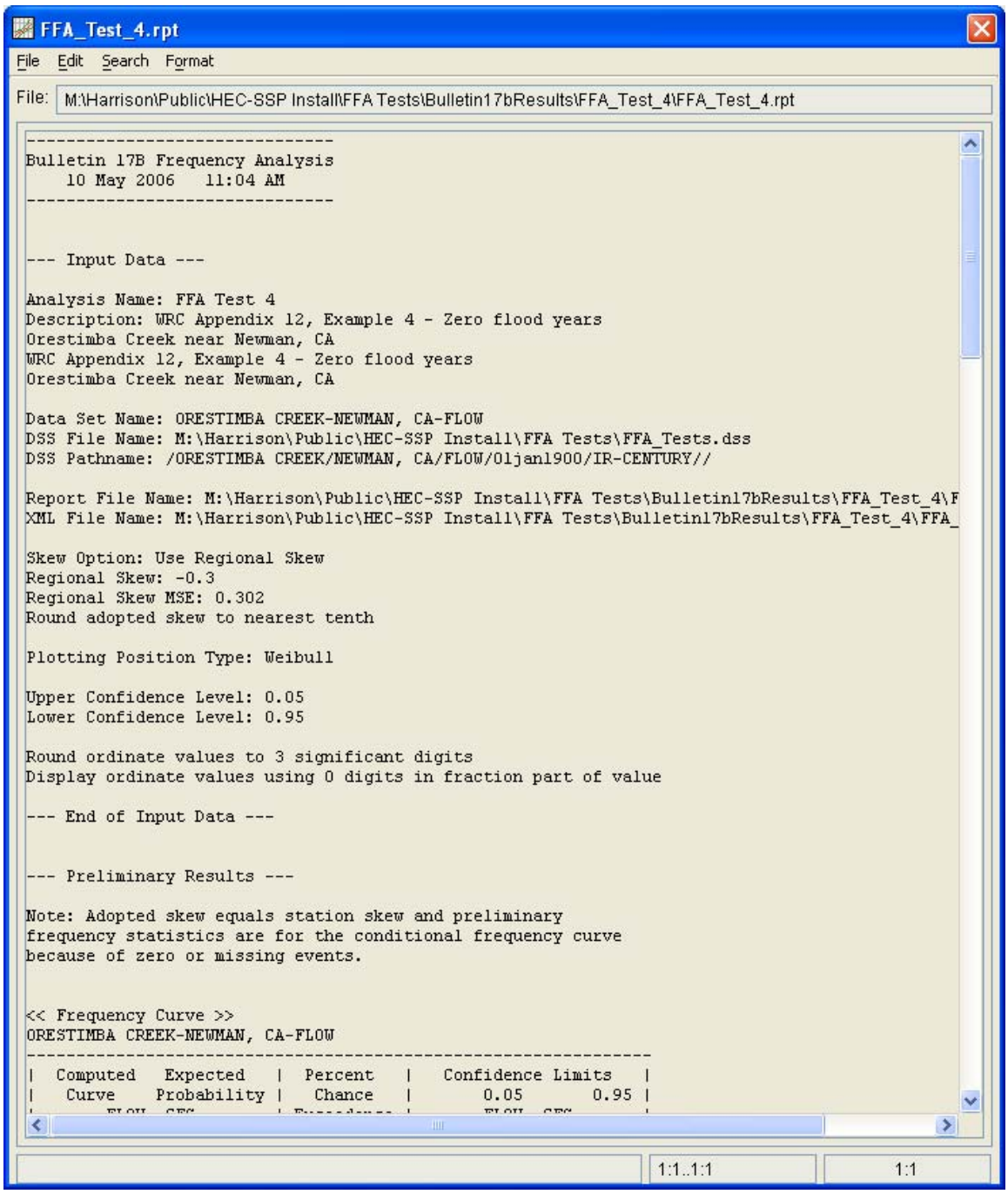


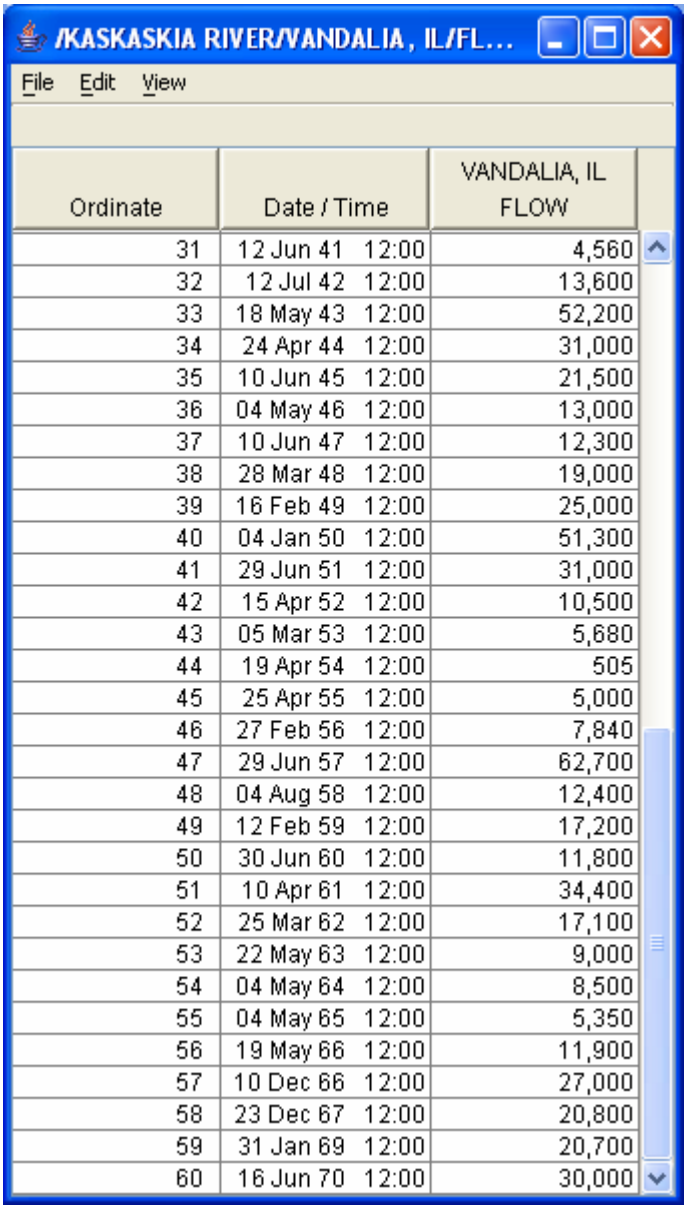
Figure B - 29. HEC-SSP Report File for Test Example 4.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

Example 5: User-entered Confidence Limits and User-entered Low Outlier Threshold

This test illustrates the use of user-entered confidence limits. Probabilities of .01 and .99 were entered for the computed confidence limit curves. This data set also includes two very low values, the higher of which is just above the default low outlier threshold. This example therefore also demonstrates the use of a user-entered low outlier threshold set to be higher than both values.

The data for this example is from Kaskaskia River in Vandalia, Illinois. The period of record used for this example is from 1908 to 1970. To view the data from HEC-SSP, right-click on the data record labeled "**KASKASKIA RIVER-VANDALIA, IL-FLOW**" in the study pane, then select **Tabulate**. The data will appear as shown in Figure B-30.



Ordinate	Date / Time	VANDALIA, IL FLOW
31	12 Jun 41 12:00	4,560
32	12 Jul 42 12:00	13,600
33	18 May 43 12:00	52,200
34	24 Apr 44 12:00	31,000
35	10 Jun 45 12:00	21,500
36	04 May 46 12:00	13,000
37	10 Jun 47 12:00	12,300
38	28 Mar 48 12:00	19,000
39	16 Feb 49 12:00	25,000
40	04 Jan 50 12:00	51,300
41	29 Jun 51 12:00	31,000
42	15 Apr 52 12:00	10,500
43	05 Mar 53 12:00	5,680
44	19 Apr 54 12:00	505
45	25 Apr 55 12:00	5,000
46	27 Feb 56 12:00	7,840
47	29 Jun 57 12:00	62,700
48	04 Aug 58 12:00	12,400
49	12 Feb 59 12:00	17,200
50	30 Jun 60 12:00	11,800
51	10 Apr 61 12:00	34,400
52	25 Mar 62 12:00	17,100
53	22 May 63 12:00	9,000
54	04 May 64 12:00	8,500
55	04 May 65 12:00	5,350
56	19 May 66 12:00	11,900
57	10 Dec 66 12:00	27,000
58	23 Dec 67 12:00	20,800
59	31 Jan 69 12:00	20,700
60	16 Jun 70 12:00	30,000

Figure B - 30. HEC-SSP Tabulation of the Peak Flow Data for Kaskaskia River.

To plot the data for this example, right-click on the data record again, then select **Plot**. A plot of the data will appear as shown in Figure B-31.

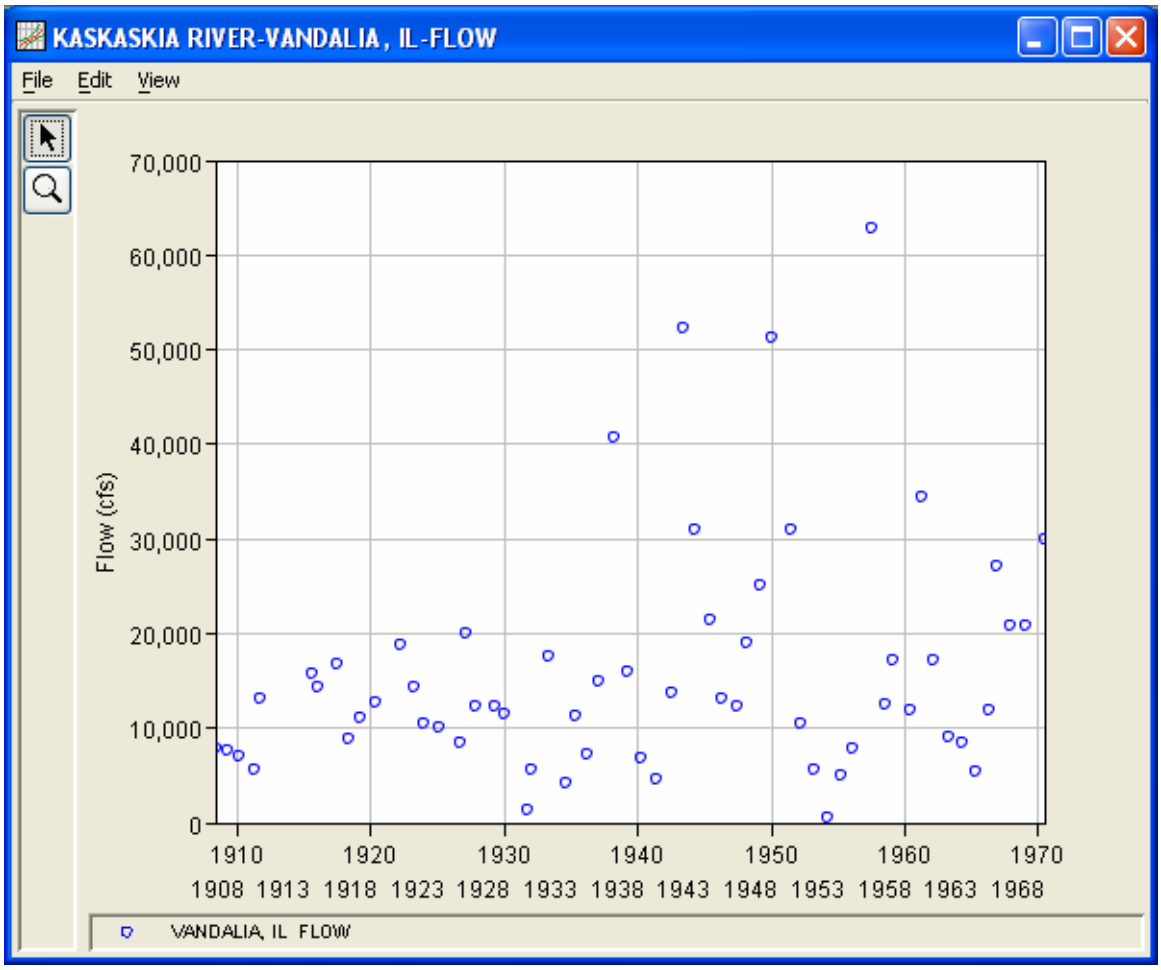


Figure B - 31. HEC-SSP Plot of the Kaskaskia River Data.

A Bulletin 17B analysis set has been developed for each of the test examples. To open the Bulletin 17B analysis editor for test example 5, either double-click on the analysis labeled **FFA Test 5** from the study pane, or from the **Analysis** menu select open, then select **FFA Test 5** from the list of available analyses. When FFA Test 5 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-32.

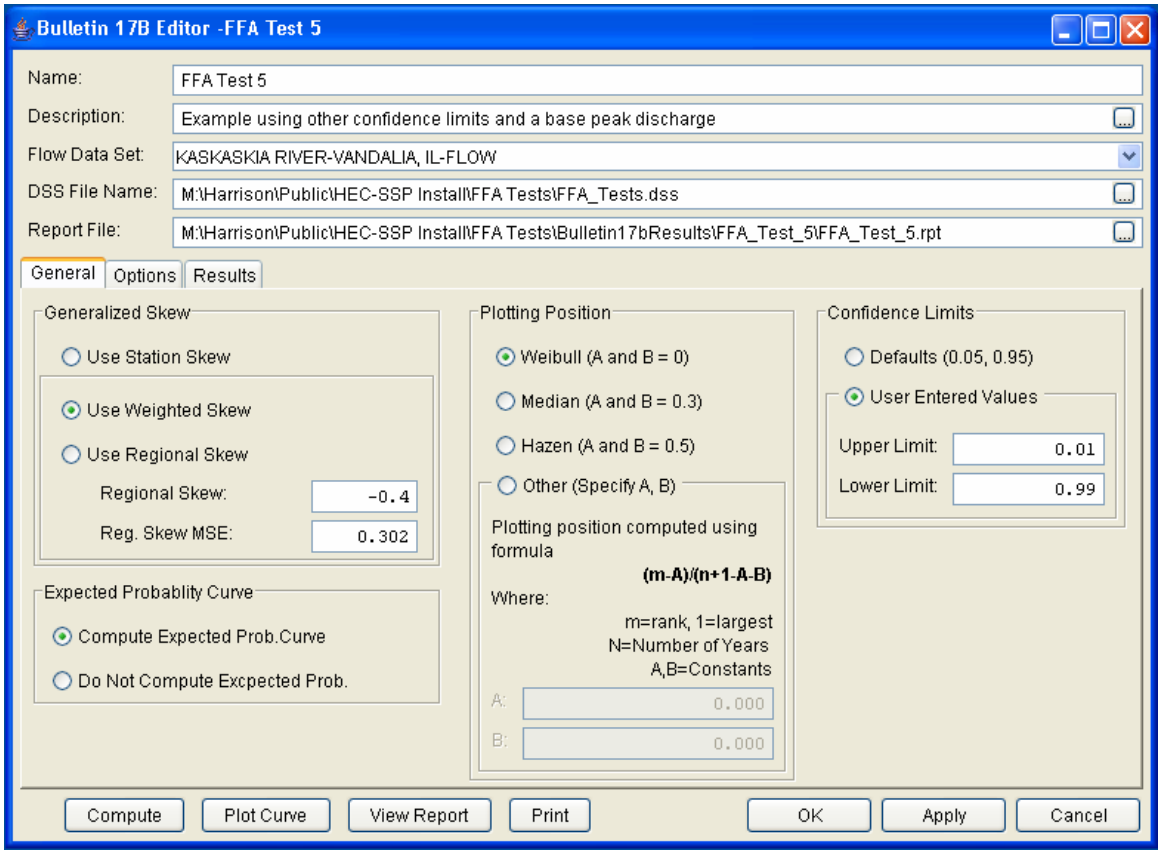


Figure B - 32. Bulletin 17B Analysis Editor for Test Example 5.

Shown in Figure B-32 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of -0.4 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve.

The default method of **Weibull** plotting positions was selected. The default values for confidence limits (.05 and .95) were changed to 0.01 (1 percent chance exceedance) and 0.99 (99% chance exceedance).

Shown in Figure B-33 is the Bulletin 17B editor with the **Options Tab** selected.

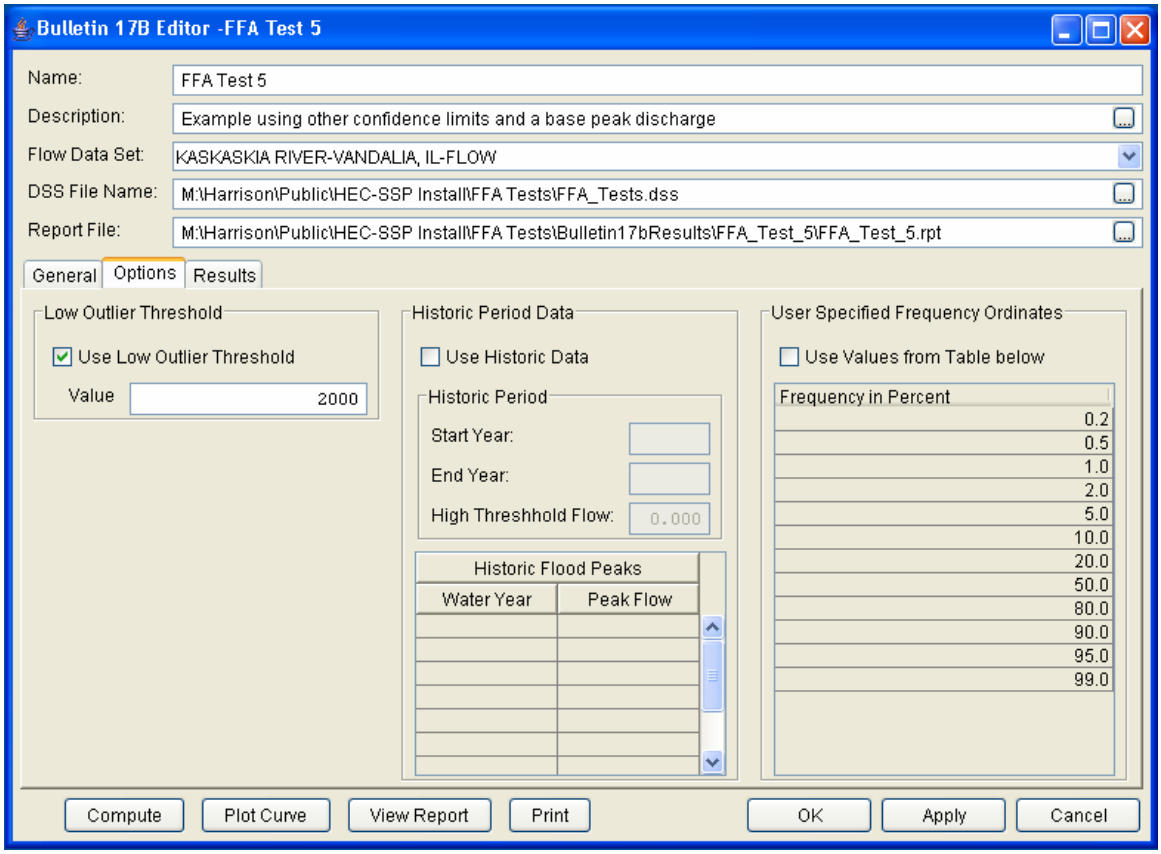


Figure B - 33. Bulletin 17B Editor with the Options Tab Shown for Test Example 5.

As shown in Figure B-33, the **Low Outlier Threshold** with an entered value of 2000 was selected. In the initial computation with this data (which the reader can reproduce by Computing without the "Use Low Outlier Threshold" box checked), the default low outlier threshold was 1,253 cfs, just below the second lowest value of 1,270 cfs. A look at the statistics and computed frequency curve from that run shows that the 1,270 cfs value is well below the curve, and with a station skew of -0.2 the frequency curve does not fit the upper data well. By choosing to also censor the 1,270 cfs value with a threshold of 2000 cfs, the fit is improved. None of the other available options such as **Historic Period Data** and the option to override the default **Frequency Ordinates** were selected for this test example.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the computations. If the data has been entered correctly, once the computations have been completed a message window will pop up and say **Compute Completed.** Close this window and then select the **Results Tab** from the analysis window. The analysis window should look Figure B-34.

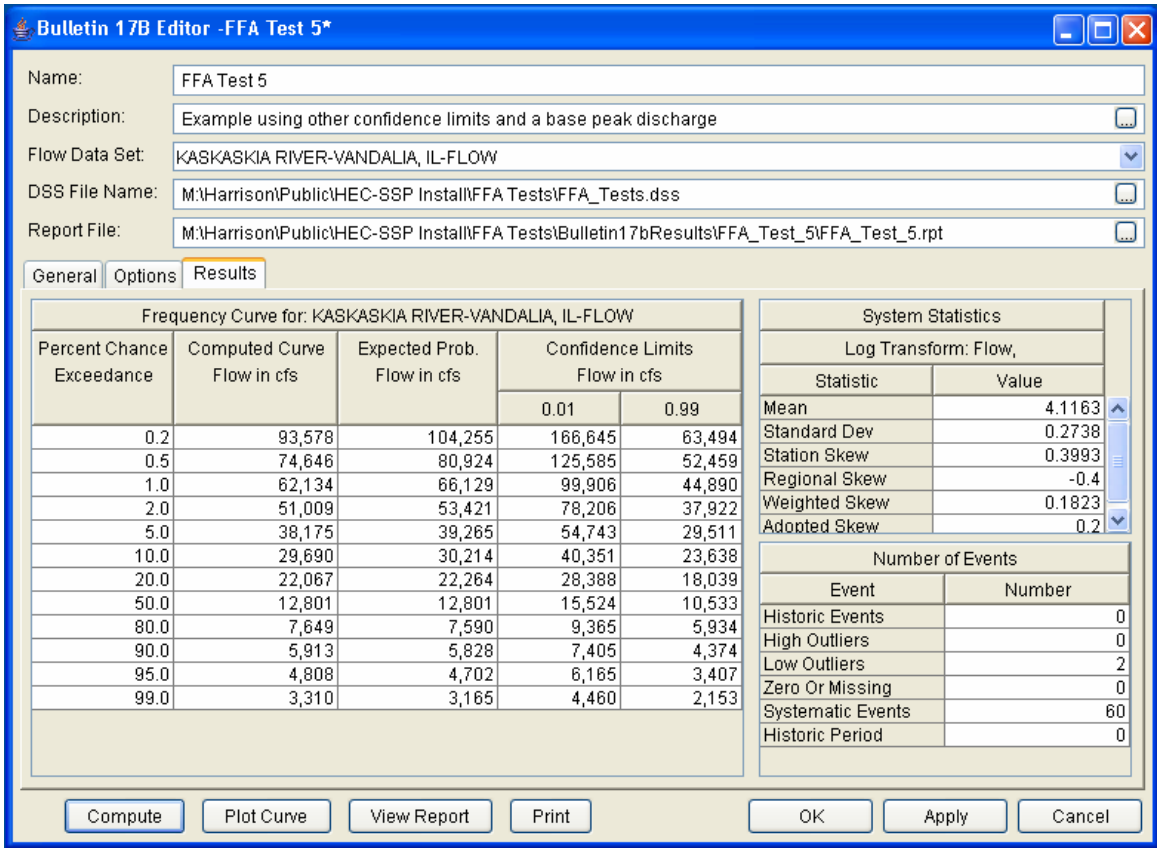


Figure B - 34. Bulletin 17B Editor with the Results Tab Selected for Test Example 5.

As shown in Figure B-34, the left table on the results tab contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (1% and 99% chance exceedance curves)

On the right-hand side of the results tab is a table of statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the right-hand side of the results tab is a table showing: the number of historic events used in the analysis; number of high outliers found; number of low outliers; number of zero or missing data years; number of systematic events in the gage record; and the historic record length (only if historic data was entered).

With the user-defined low-outlier threshold of 2000 cfs, there are 2 low-outliers detected, and the reported statistics result from the

software omitting those values and then using the Conditional Probability Adjustment to recompute the resulting frequency curve and statistics. The report file (described below) includes the preliminary computation before removal of outliers and the default and user-defined outlier thresholds, as well as the final frequency curve and statistics.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-35.

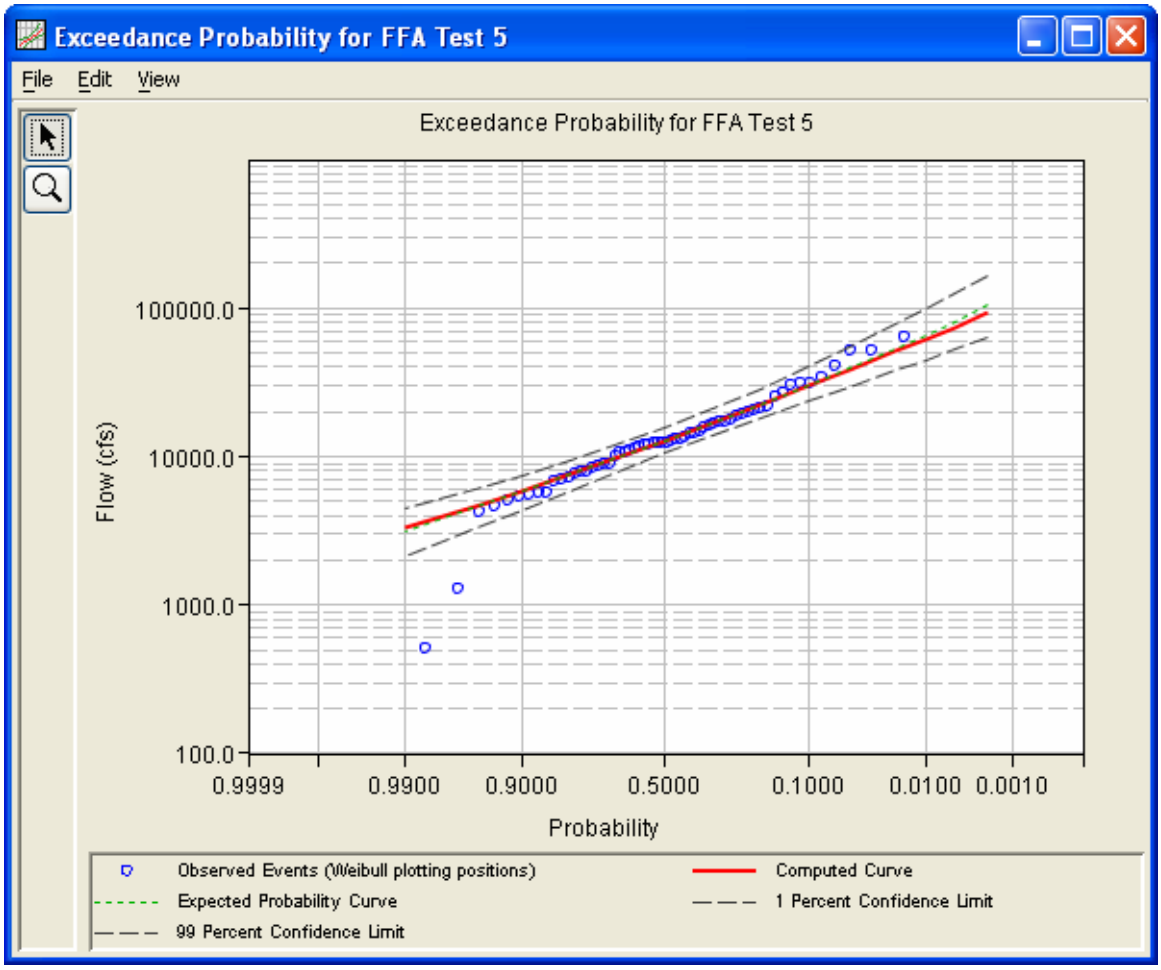


Figure B - 35. HEC-SSP Plot of the Frequency Curve Results for Test Example 5.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data files you want to send to the clipboard and then press the Control-C key sequence to send the data. To print the graphical results, first bring up the graphical plot, then select **Print**

from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-36 is the report file for test example 5.

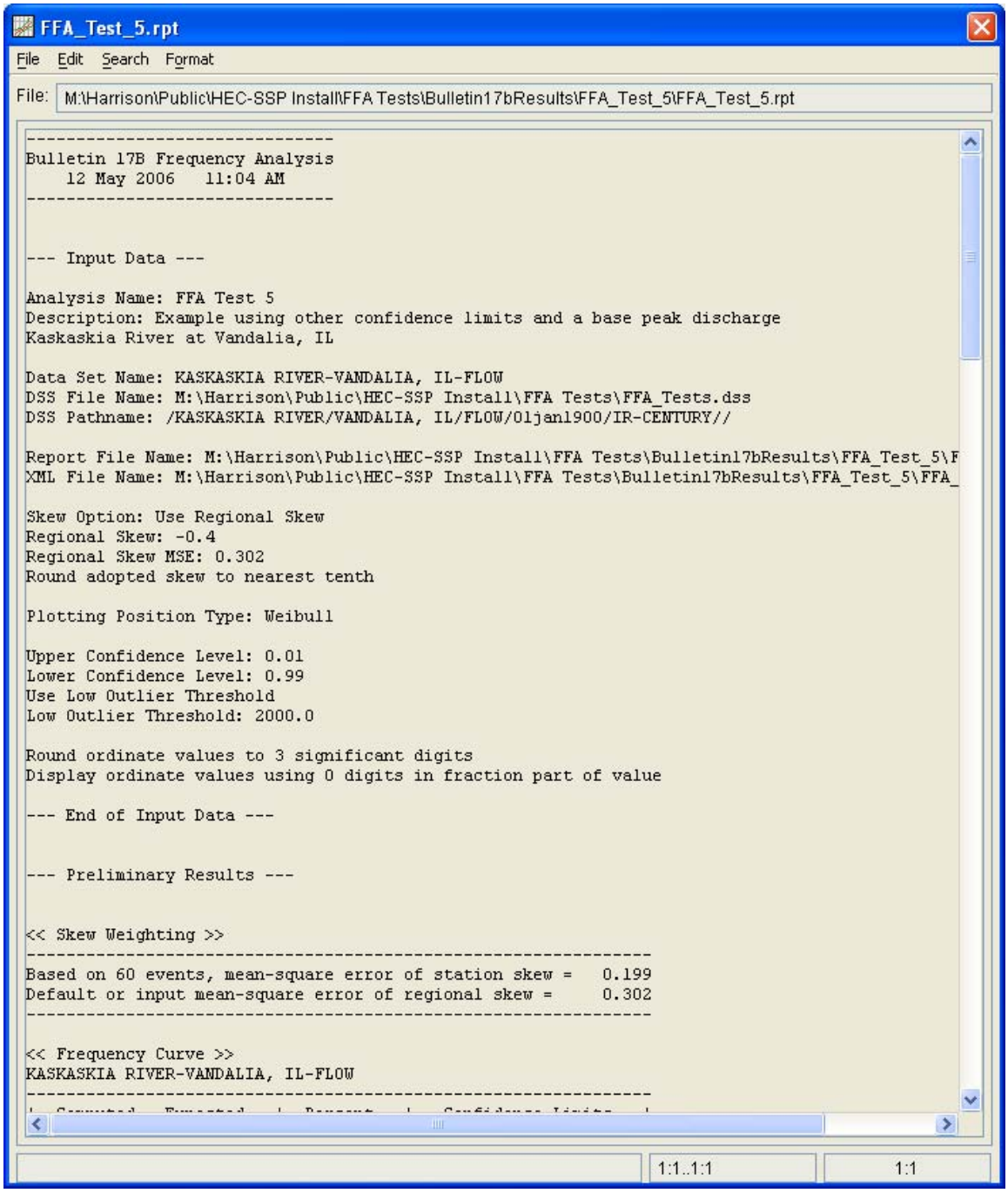


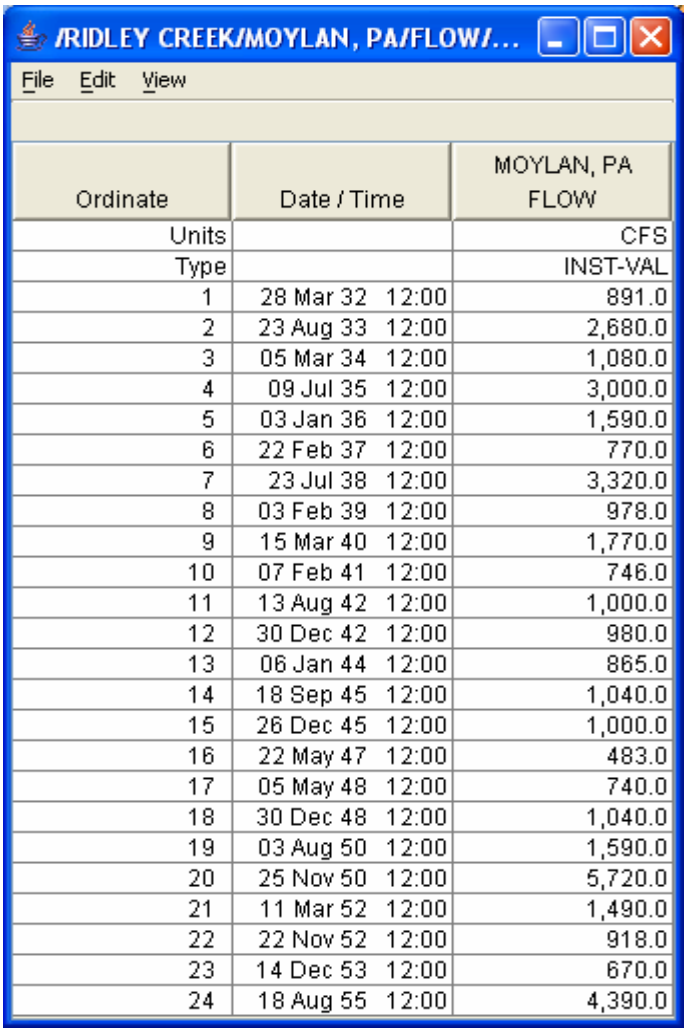
Figure B - 36. HEC-SSP Report File for Test Example 5.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

Example 6: Incorporating Historic Data

This test demonstrates how to use historic information to improve a flow frequency analysis. A historic flood peak of 15,000 cfs which occurred in 1843 is included in the analysis. This value is the highest known value up to the present time (1974 for this example), even though the systematic record stopped in 1955.

The data for this example is from Ridley Creek in Moylan, Pennsylvania. The period of record used for this example is from 1932 to 1955. To view the data from HEC-SSP, right-click on the data record labeled "**RIDLEY CREEK-MOYLAN, PA-FLOW**" in the study pane, then select **Tabulate**. The data will appear as shown in Figure B-37.



Ordinate	Date / Time	MOYLAN, PA FLOW
Units		CFS
Type		INST-VAL
1	28 Mar 32 12:00	891.0
2	23 Aug 33 12:00	2,680.0
3	05 Mar 34 12:00	1,080.0
4	09 Jul 35 12:00	3,000.0
5	03 Jan 36 12:00	1,590.0
6	22 Feb 37 12:00	770.0
7	23 Jul 38 12:00	3,320.0
8	03 Feb 39 12:00	978.0
9	15 Mar 40 12:00	1,770.0
10	07 Feb 41 12:00	746.0
11	13 Aug 42 12:00	1,000.0
12	30 Dec 42 12:00	980.0
13	06 Jan 44 12:00	865.0
14	18 Sep 45 12:00	1,040.0
15	26 Dec 45 12:00	1,000.0
16	22 May 47 12:00	483.0
17	05 May 48 12:00	740.0
18	30 Dec 48 12:00	1,040.0
19	03 Aug 50 12:00	1,590.0
20	25 Nov 50 12:00	5,720.0
21	11 Mar 52 12:00	1,490.0
22	22 Nov 52 12:00	918.0
23	14 Dec 53 12:00	670.0
24	18 Aug 55 12:00	4,390.0

Figure B - 37. HEC-SSP Tabulation of the Peak Flow Data for Ridley Creek.

To plot the data for this example, right-click on the data record again, then select **Plot**. A plot of the data will appear as shown in Figure B-38.

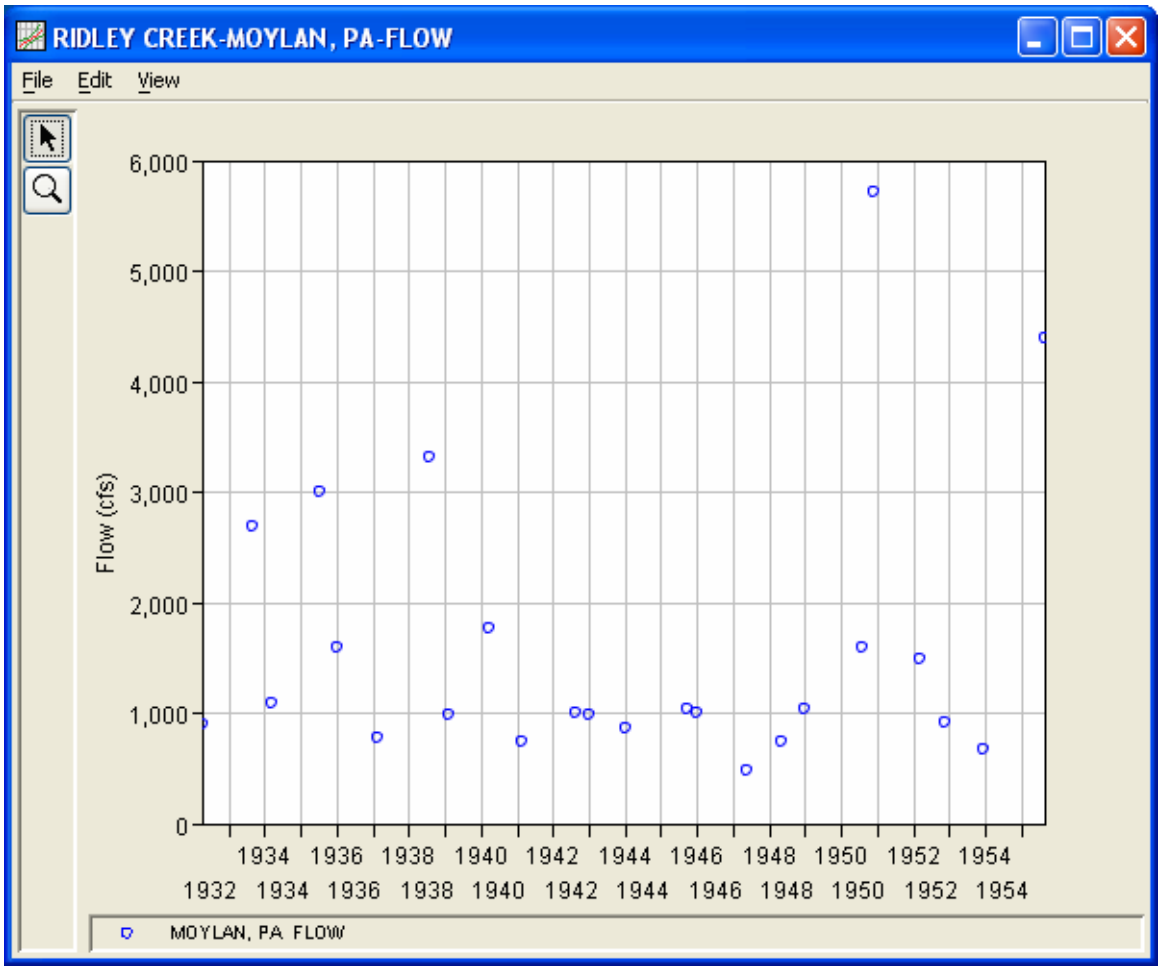


Figure B - 38. HEC-SSP Plot of the Ridley Creek Data.

A Bulletin 17B analysis set has been developed for each of the test examples. To open the Bulletin 17B analysis editor for test example 6, either double-click on the analysis labeled **FFA Test 6** from the study pane, or from the **Analysis** menu select open, then select **FFA Test 6** from the list of available analyses. When FFA Test 6 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-39.

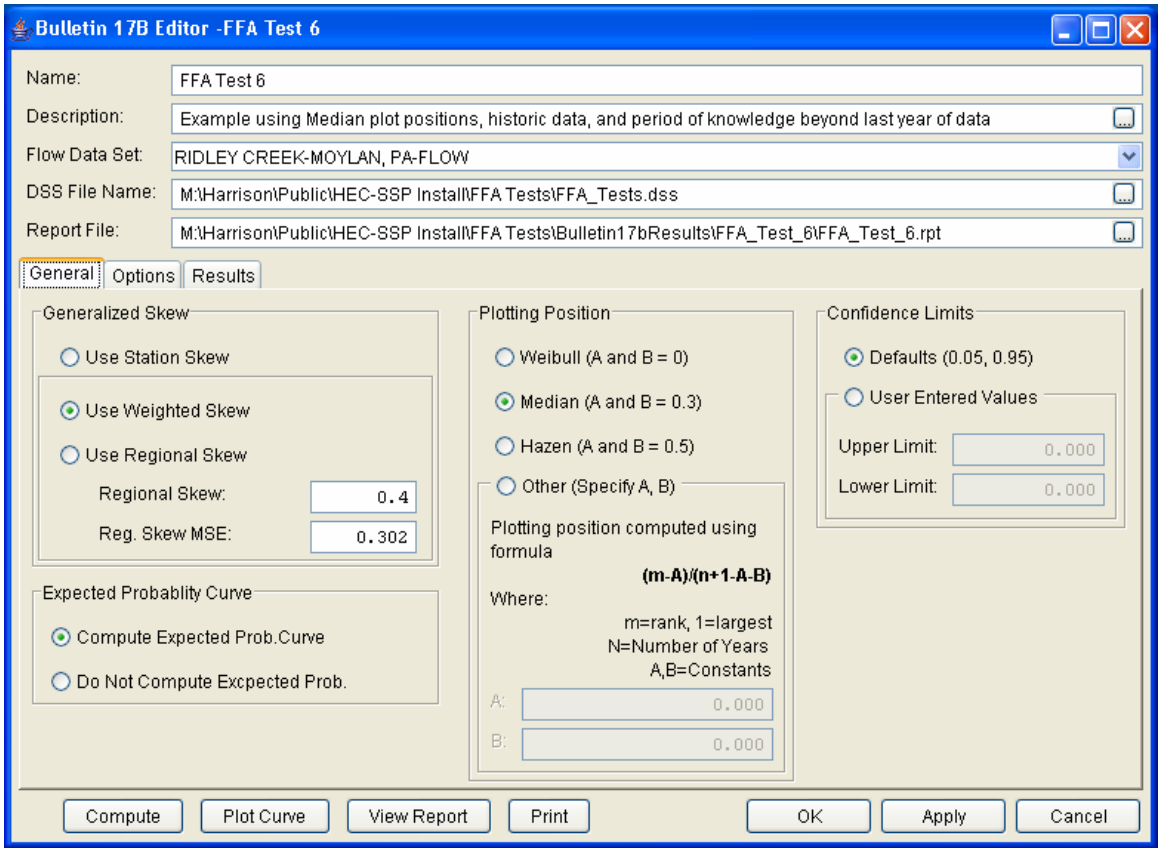


Figure B - 39. Bulletin 17B Analysis Editor for Test Example 6.

Shown in Figure B-39 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of 0.4 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve.

The **Median** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance).

Shown in Figure B-40 is the Bulletin 17B editor with the **Options Tab** selected.

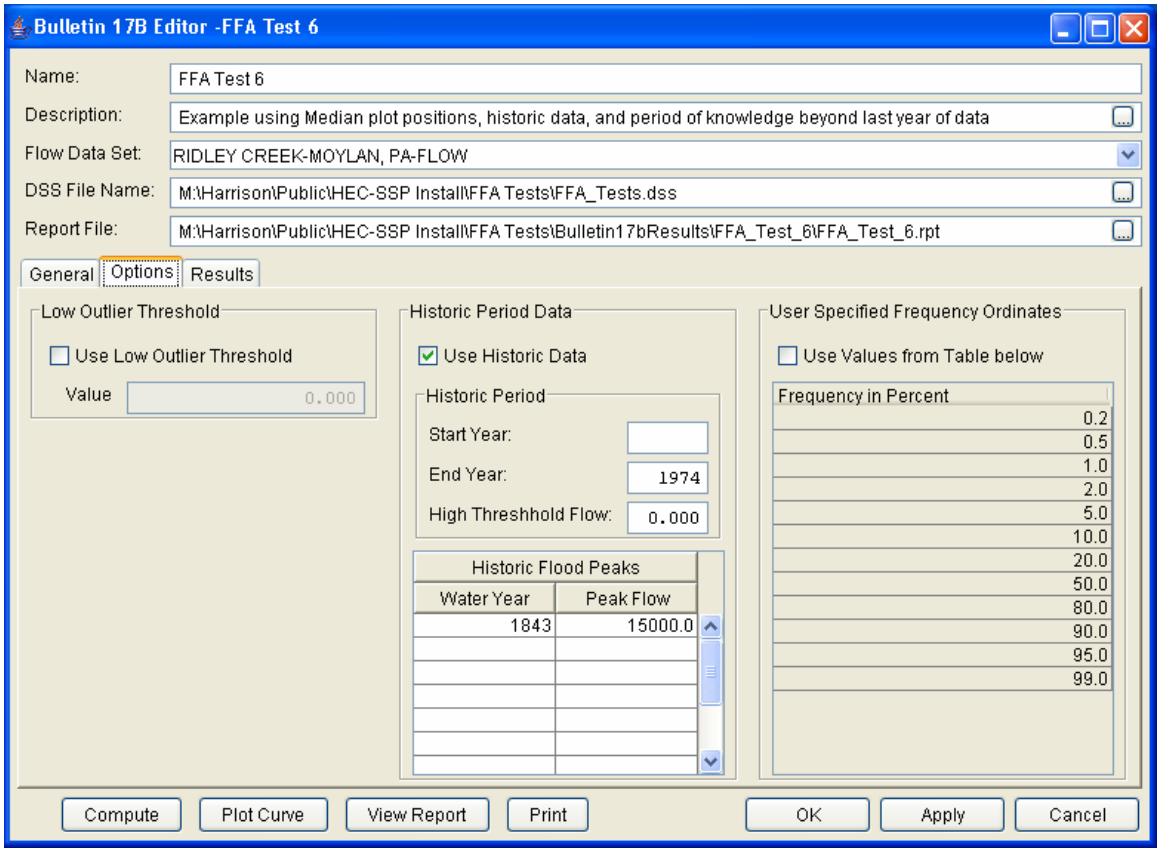


Figure B - 40. Bulletin 17B Analysis Editor with Options Tab Shown.

As shown in Figure B-40, the **Historic Period Data** option has been selected to reflect a historical flood event of 15,000 cfs in 1843 and an analysis period from 1843 to 1974. Historic Period Data is used to account for historic flood events large enough to be relevant to the analysis and not contained in the systematic data record. The additional information provided by historic data can improve the Flood Frequency Analysis, especially when the data collection period for a given area is relatively short. Information for a **Historic Flood Peak** has been entered to account for a peak flow of 15,000 cfs in the 1843 water year. The Historic Period **Start Year** has been left blank. By default this value will be the earliest year found in the historic flood peaks data or the systematic record. Therefore for this example, 1843 will automatically be used for the Start Year of the Historic Period. An **End Year** of 1974 has been entered. The systematic record for the gage ended in 1955, however when this analysis was performed in 1974, no other flood peaks of consequence had been observed between 1955 and 1974. Therefore, 1974 is set as the End Year for the historic period analysis.

Other features in this tab include using the **Low Outlier Threshold** and the option to override the default **Frequency Ordinates** neither of which are selected in this example.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the computations. If the data has been entered correctly, once the computations have been completed a message window will pop up and say **Compute Completed.** Close this window and then select the **Results Tab** from the analysis window. The analysis window should look Figure B-41.

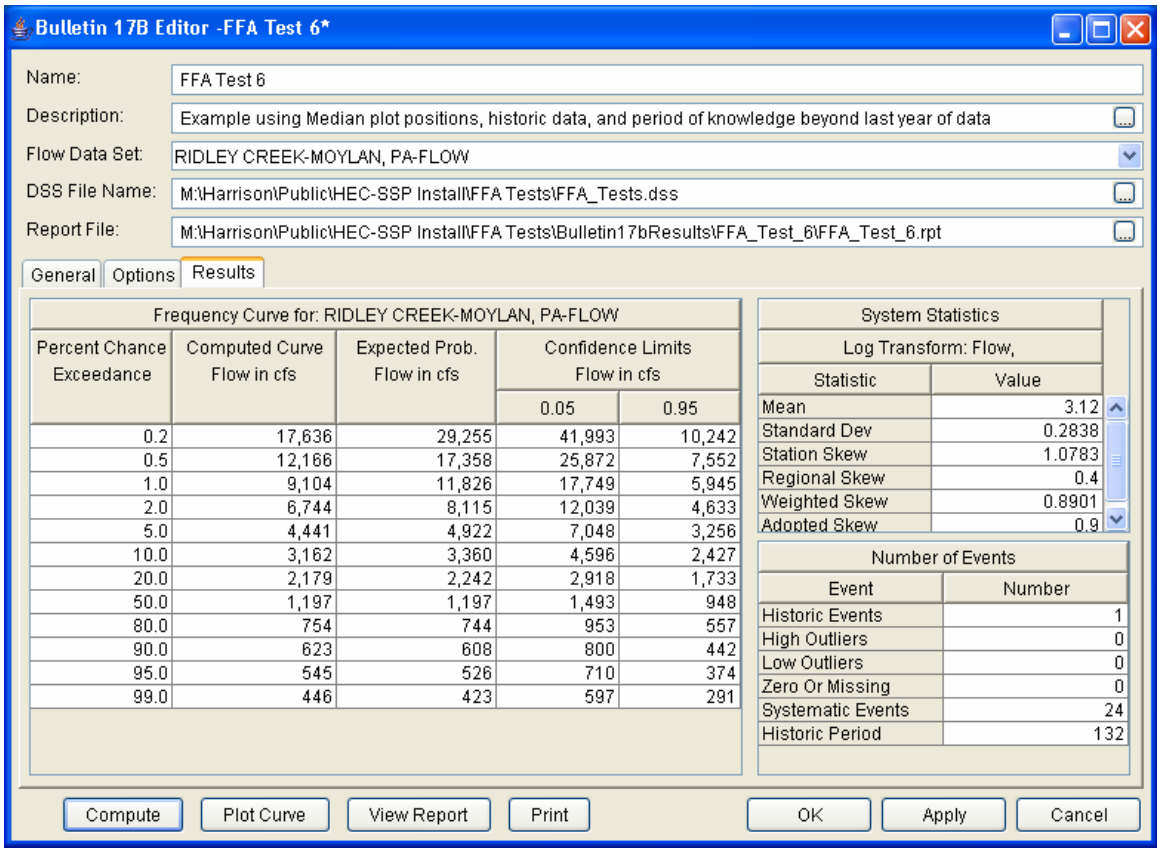


Figure B - 41. Bulletin 17B Editor with the Results Tab Selected for Test Example 6.

As shown in Figure B-41, the left table on the results tab contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the right-hand side of the results tab is a table of statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the right-hand side of the results tab is a table

showing: the number of historic events used in the analysis; number of high outliers found; number of low outliers; number of zero or missing data years; number of systematic events in the gage record; and the historic record length (if historic data was entered).

This example reports one historical flood event, and a historical period of 132 years, between 1843 and 1974. The reported statistics reflect the use of the historical data adjustment outlined in Bulletin 17B Appendix 6. The report file (described below) shows the initial computation of the statistics and frequency curve before the historical data was used, and the resulting statistics and frequency curve after the historical data is taken into account.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-42.

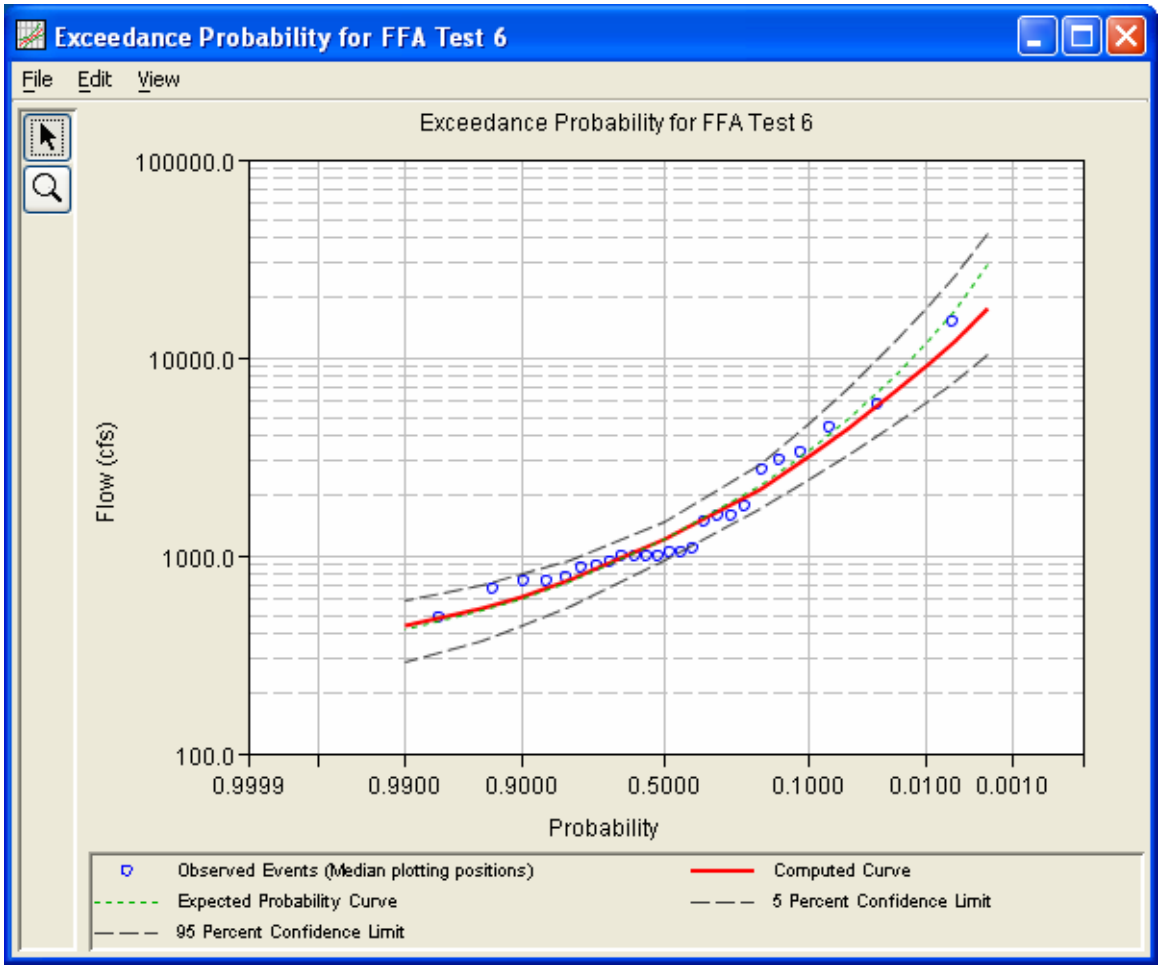


Figure B - 42. HEC-SSP Plot of the Frequency Curve Results for Test Example 6.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print

the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data files you want to send to the clipboard and then press the Control-C key sequence to send the data. To print the graphical results, first bring up the graphical plot, then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-43 is the report file for test example 6.

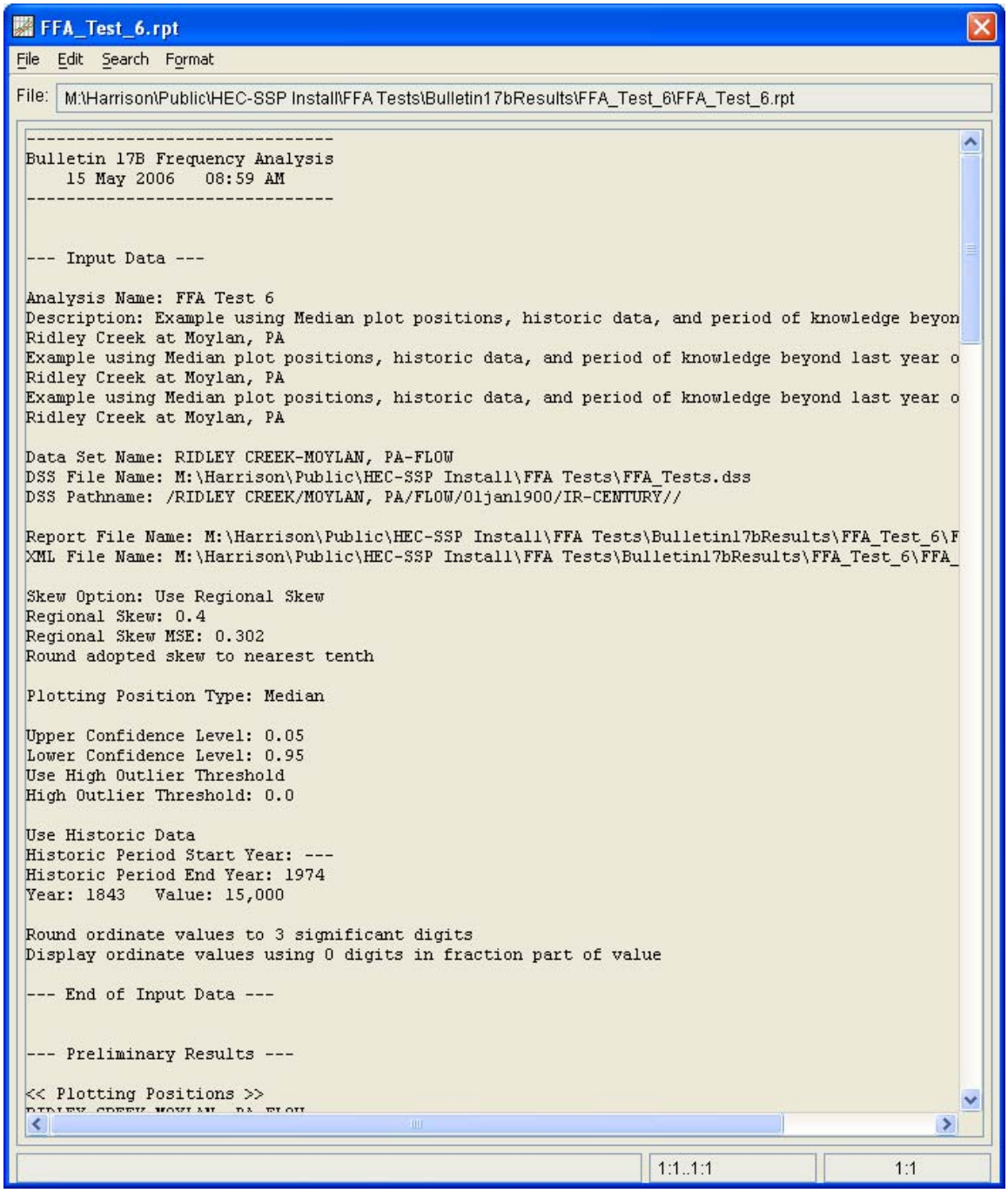


Figure B - 43. HEC-SSP Report File for Test Example 6.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis

APPENDIX C

Customizing Plots

The graphic customizing capabilities within HEC-SSP are very powerful, but are also somewhat complex to use. The software used in developing the plots in HEC-SSP is the same code that was used for developing graphics in HEC-DSSVue and several other HEC software programs. This appendix documents how to customize plots in a generic manner. The example plots in this section are from HEC-DSSVue, not HEC-SSP. Figure C-1 shows a sample plot illustrating raw and revised data for stage and flow at a location called Beech Creek Station.

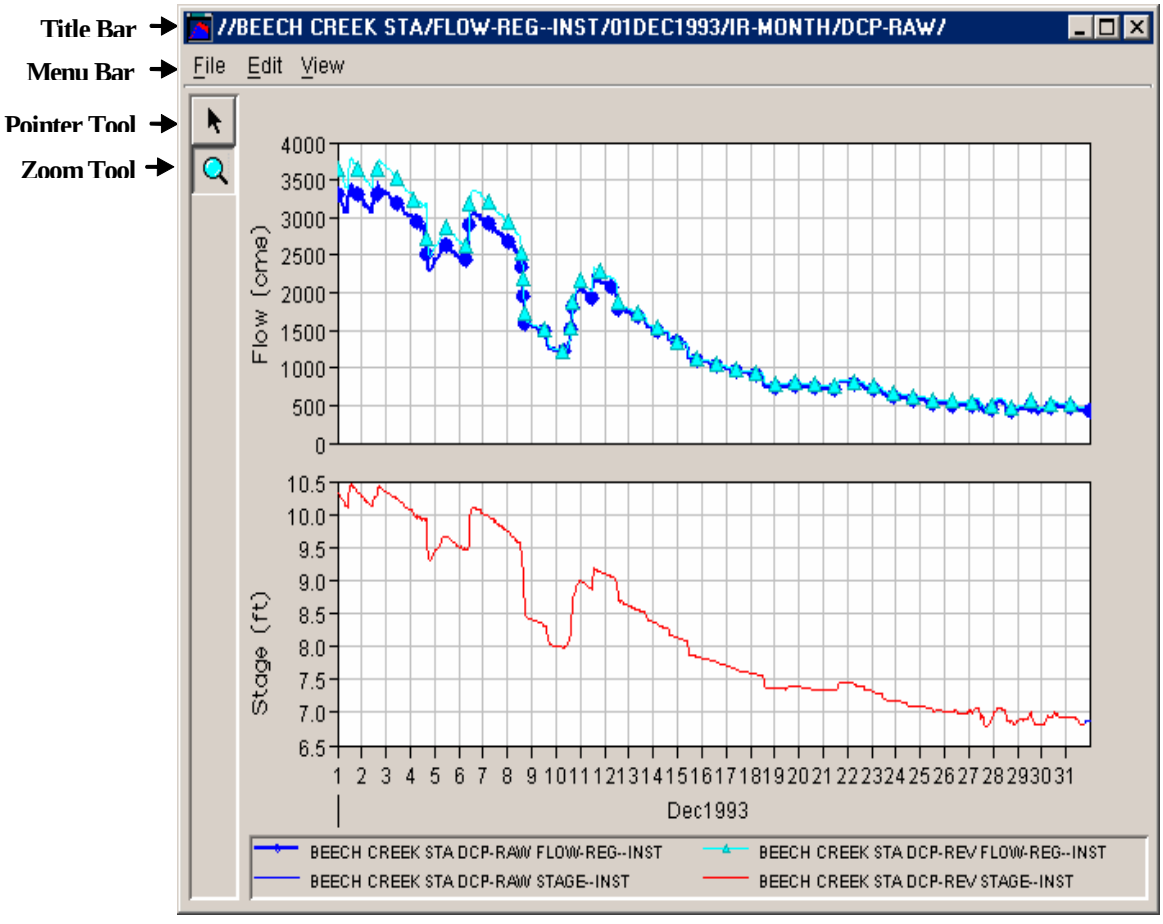


Figure C-1. Plot Window

With the **Pointer Tool**  , you can access shortcut menus that allow you to customize features of your plots using the plot window's editing tools. The following sections discuss these tools in detail. The **Zoom Tool**  allows you to view data closely at a specific time. To zoom in, select the Zoom Tool then "draw" a rectangle around the section of the plot you wish to enlarge. To zoom out, right-click anywhere in the display area using the Zoom Tool.

If you wish to keep the plot window on top of your desktop so you can view it while working in other windows, you can select Always on Top from the View menu. A check mark indicates this option is active.

Customizing Plots: Overview

Plot properties editors allow you to configure default properties for plots as well as customize individual plots. Figure C-2 shows the features of plots you can configure.

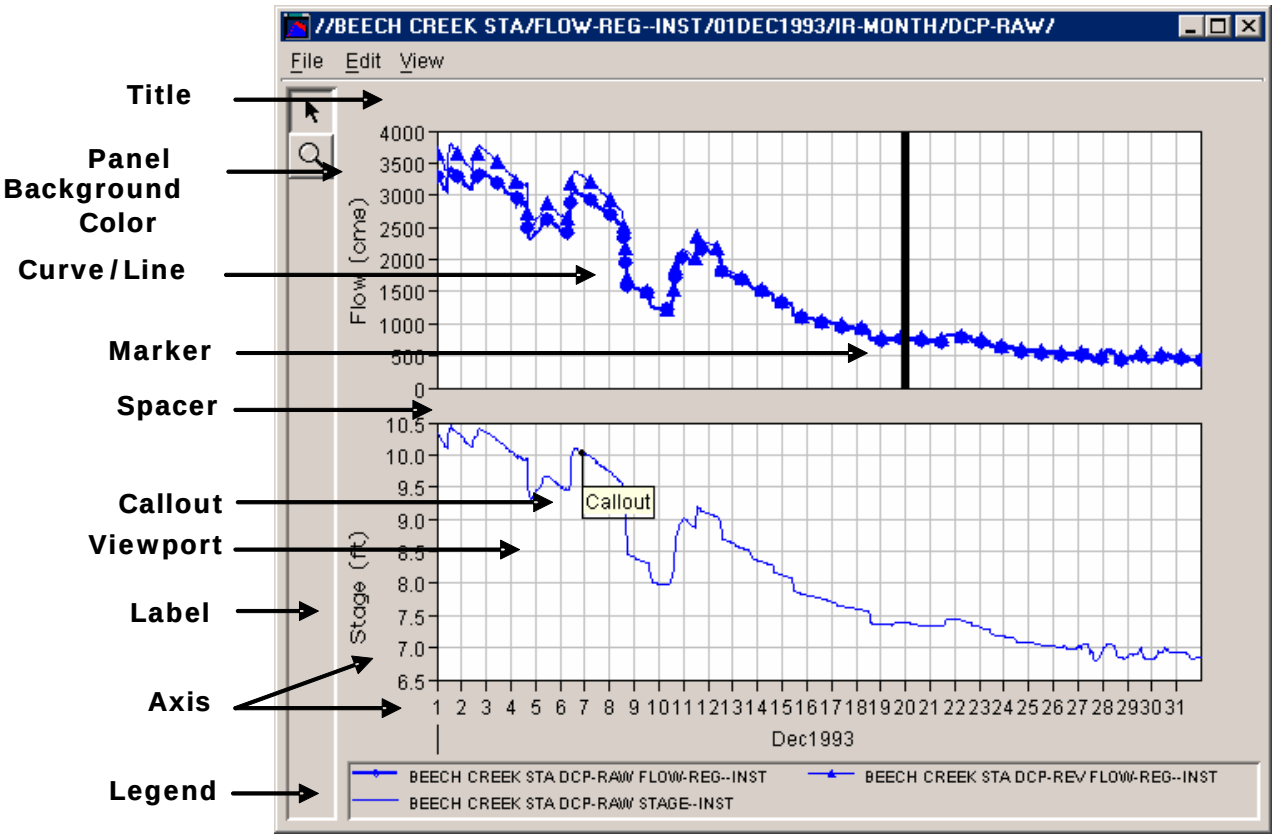


Figure C-2. Configurable Features of Plots

Title: Optionally, you can add a title to the plot display.

Panel Background Color: You can specify the background color of the plot window (light grey is the default).

Curve/Line Properties: You can choose the line and point styles, add labels, and specify symbols to indicate quality.

Marker: You can add markers on the X and Y axes and customize the appearance of these markers.

Spacer: You can specify the distance between viewports, between a viewport and the legend, and the width of side margins.

Callout: You can add descriptive callouts at specific points along a line.

Viewport: You can customize the border around the viewport, the background color and pattern, and the appearance of gridlines. You can also specify the number, size, and content of viewports.

Label: You can add borders and backgrounds to axis and legend labels.

Axis: You can specify either a linear or log axis type, specify the axis scale, and customize tic marks.

Legend: You can add titles to the plot legend and specify whether the legend appears below or to the right of the plot.

Using Plot Editors

Several different editing interfaces allow you to either set defaults for all plots or specify properties of individual plots. Figure C-3 shows three examples: the Default Plot Properties Editor, the Plot Properties Editor, and the Viewport Properties Editor.

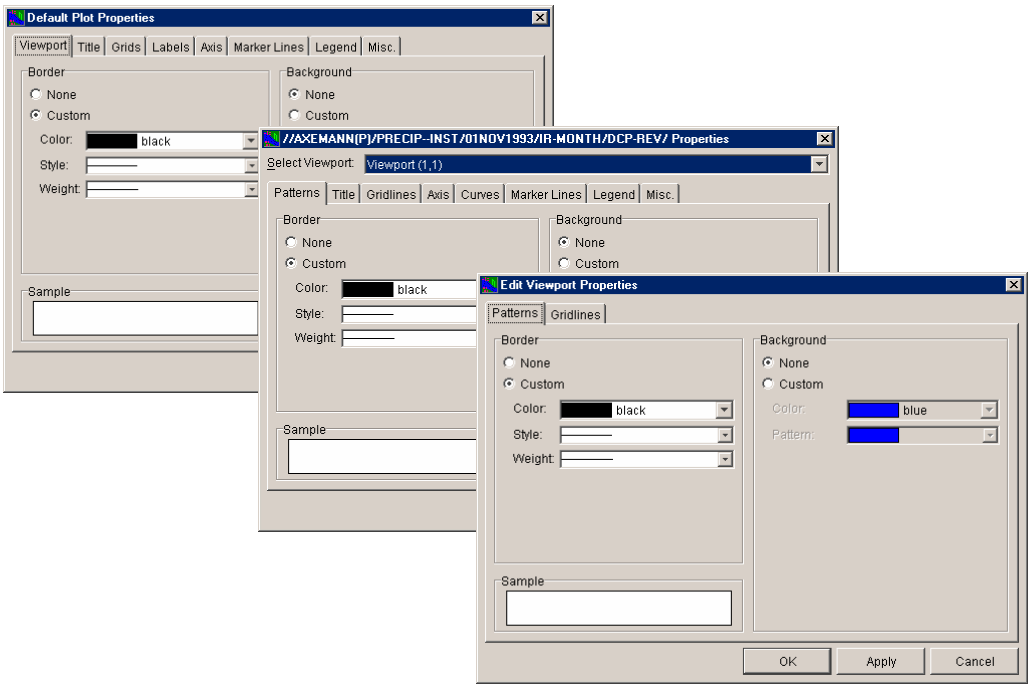


Figure C-3. Examples of Plot Properties Editors

As Figure C-3 illustrates, the editors can look almost identical to each other. Therefore, it is necessary for you to understand what the editors do and how to access the correct editor for your purpose.

Setting Defaults vs. Customizing Individual Plots

Plot editors and tools fall into two categories in terms of function: either they allow you to specify defaults for all plots you create, or they allow you to customize individual plots.

Across these two functional categories, the plot editors and tools either allow you to edit a variety of plot properties, or they can be specialized editors that allow you to edit a single property.

To configure the default appearance of all plots, you need to use the Default **Plot Properties Editor** and **Default Line Style Options Editor**. All settings you specify in these editors will apply to all new plots you open. You can access these editors only from the **Edit** menu of plots.

To customize individual plots, you can use the **Plot Properties Editor** and the **Configure Plot Editor**, both accessed from the **Edit** menu of a plot window. Also, using right-click shortcut menus, you can access specialized editors for individual plot features. The **Viewport Properties Editor** is an example of a specialized editor.

Additionally, once you have customized an individual plot, you can export its settings as a **Template** that you can apply to other plots. To create a template based upon a plot, you will use the **Export Properties** option in the **File** menu of the plot window.

Likewise, you can import Templates to apply previously defined properties to an individual plot. To apply a template to a new plot, you will use the **Import Properties** option in the **File** menu of the new plot window.

Accessing Editors

You can access properties editors from **shortcut menus** (Figure C-4) and from the **Edit** menu in the plot window (Figure C-5).

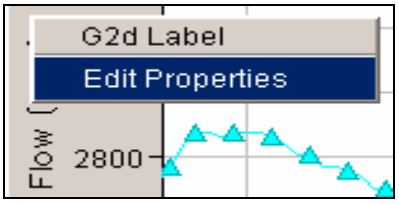


Figure C-4. Shortcut Menu

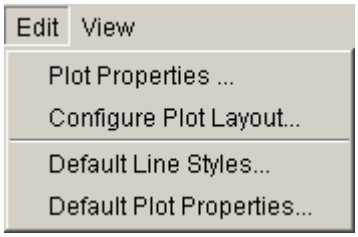


Figure C-5. Edit Menu

You will use these menus according to whether you are defining properties for an individual plot or setting default properties for all plots you create.

Use **shortcut menus** to edit specific components of an individual plot. For example, if you want to edit axis label properties on a plot, right-click on the axis label to access the shortcut menu for the label (Figure C-4), then select the **Edit Properties** command for the label.

Use the **Edit** menu of a plot window to access the **Plot Properties Editor**, **Default Line Style Options Editor**, **Default Plot Properties Editor**, and **Configure Plot Editor**. These editors, discussed in Section below, allow you to edit a variety of plot properties.

Recognizing Plot Editors and Tools

Following is an overview of the editing tools that allow you to customize plots. Later sections provide more detailed instructions on editing specific plot properties using these tools.

Plot Properties Editor

The **Plot Properties Editor** (Figure C-6) is accessed from the **Edit** menu of a plot, and allows you to configure multiple display properties of an individual plot, including the Curves, Axis, the plot Title, Gridlines, border and background Patterns of the viewport, Marker Lines, Legend, and properties of the plot window panel.

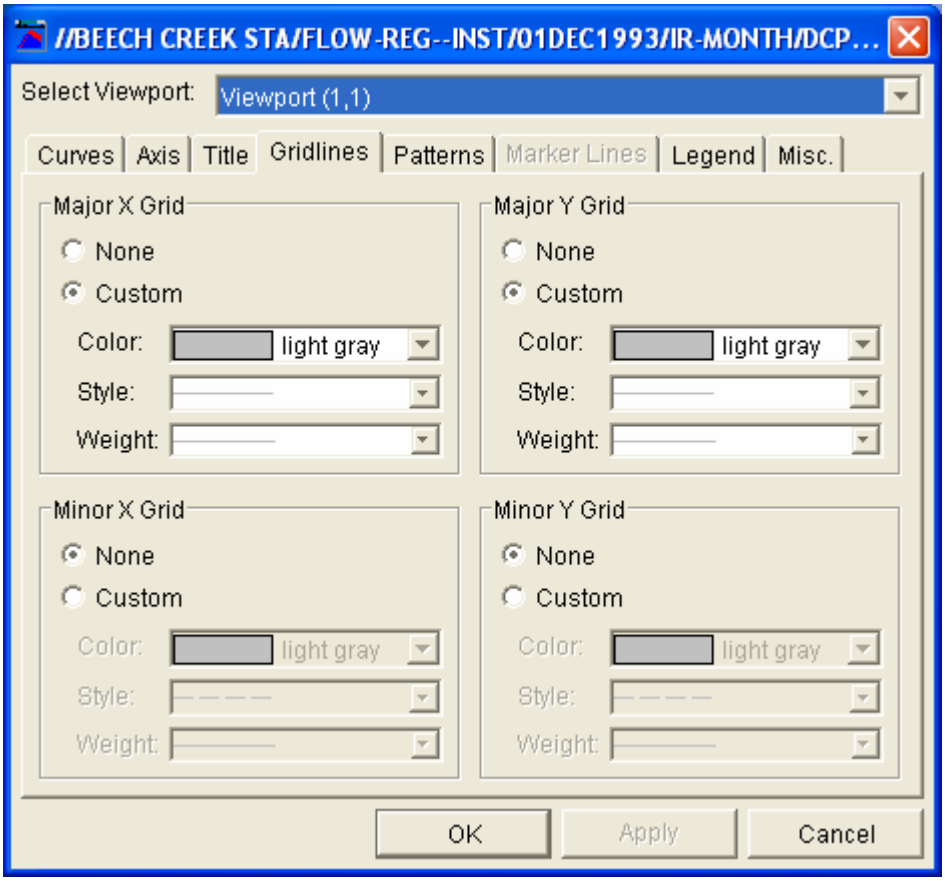


Figure C-6. Plot Properties Editor

When you customize properties of a plot using the Plot Properties Editor, your changes apply only to that individual plot unless you export the plot's properties.

To access the Plot Properties Editor, from the **Edit** menu, choose **Plot Properties**.

Individual Plot Property Editors

When you want to edit a specific property of a plot without launching the Plot Properties Editor, you can use individual plot property editors instead. These individual plot property editors correspond to the tabs of the Plot Properties Editor.

To access an individual plot property editor, right-click on the element you want to edit, then select **Edit Properties** from the shortcut menu.

For example, if you right-click inside the gridded plot area, called the viewport, you will see the Viewport shortcut menu (Figure C-7). When you choose Edit Properties, the Viewport Properties Editor will open (Figure C-8).

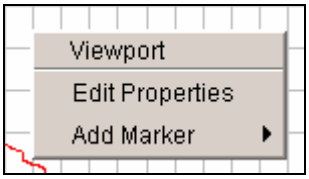


Figure C-7. Viewport Shortcut Menu

The **Viewport Properties Editor** lets you edit only properties associated with the viewport, using the same Patterns and Gridlines tabs as appear in the Plot Properties Editor.

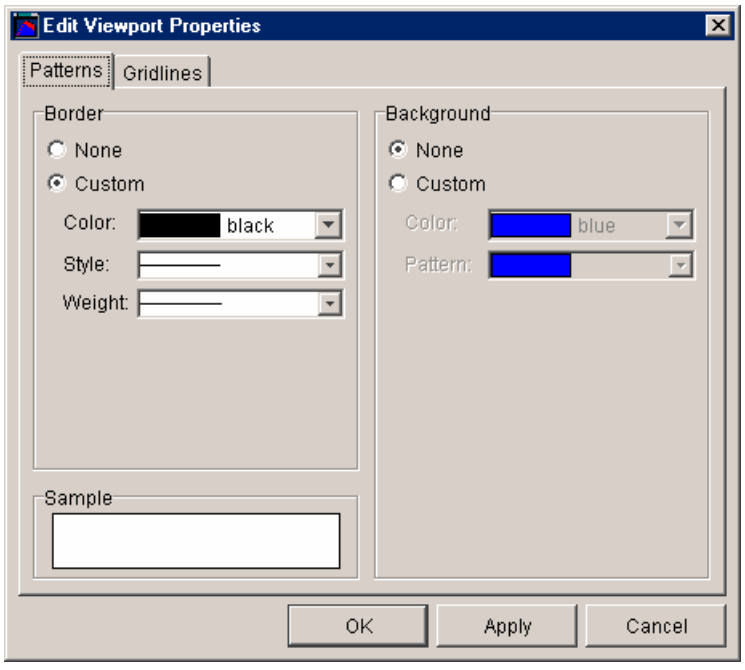


Figure C-8. Viewport Properties Editor

Other individual properties editors are the **Title Properties Editor**, **Axis Properties Editor**, **Curve Properties Editor**, **Label Properties**

Editor, **Marker Properties Editor**, **Legend Properties Editor**, and the **Spacer Properties Editor**.

The only plot property you cannot edit using an individual property editor is the color of the plot window panel.

Configure Plot Editor

The **Configure Plot Editor** (Figure C-9) is accessed from the **Edit** menu of a plot and allows you to customize the layout of an individual plot. You can add and remove axes and add, remove, arrange the order of, and set the weight of viewports in the plot window.

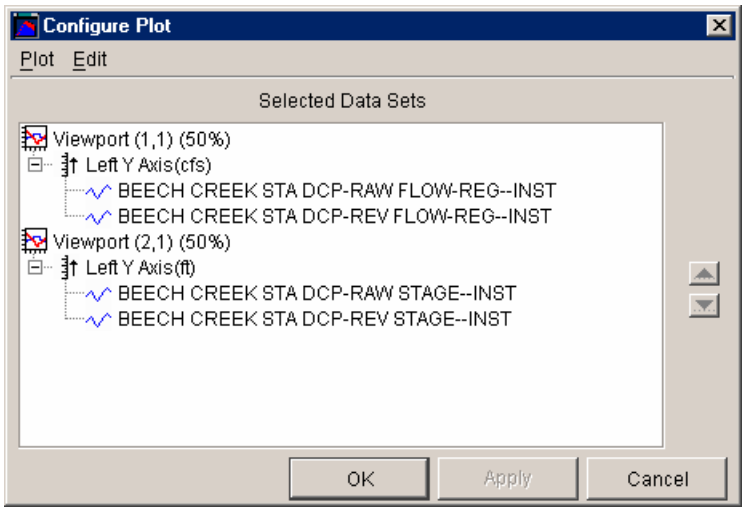


Figure C-9. Configure Plot Editor

When you customize the layout of a plot using the Configure Plot Editor, your changes apply only to that individual plot unless you export the plot's properties.

To access the Configure Plot Editor, from the **Edit** menu, click **Configure Plot Layout**.

Default Line Style Options Editor

With the **Default Line Style Options Editor** (Figure C-10), you can specify the default line and fill styles, as well as labels, used across all plots for specific parameters.

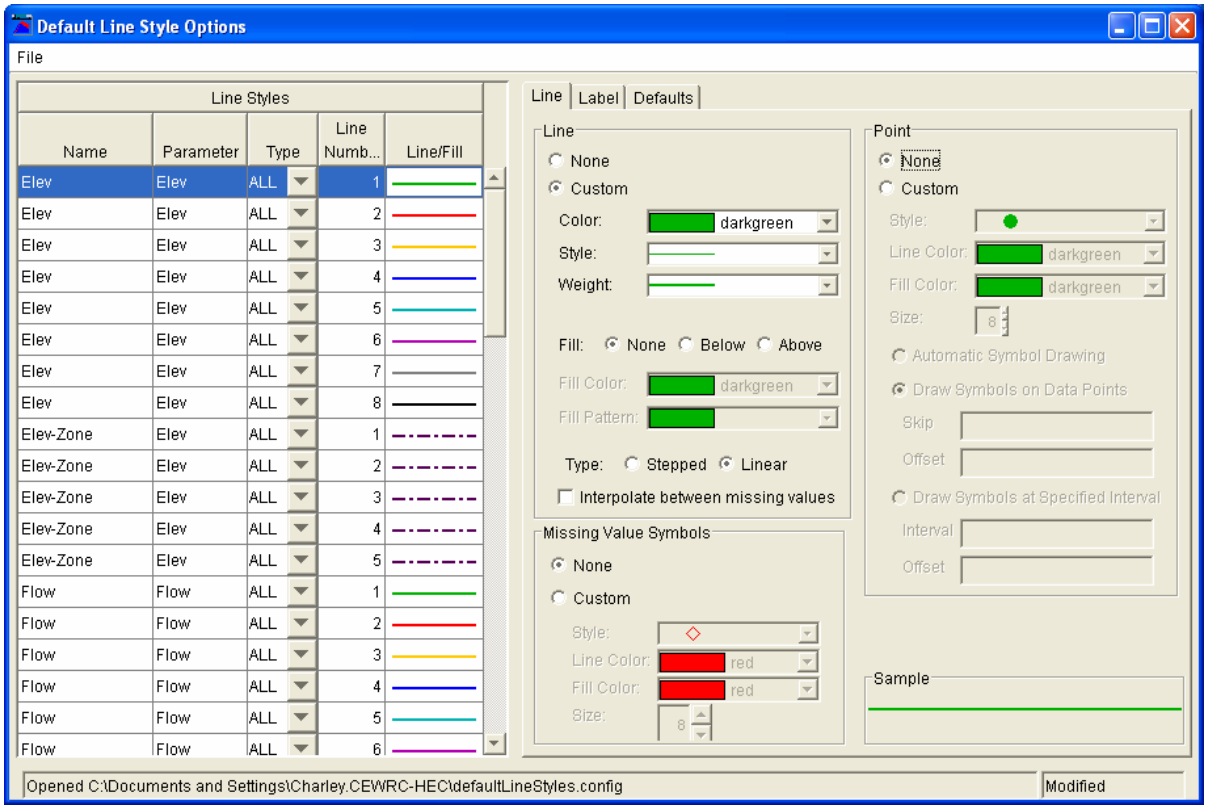


Figure C-10. Default Line Style Options Editor

To access the Default Line Style Options Editor, from the Edit menu, choose Default Line Styles.

Default Plot Properties Editor

The **Default Plot Properties Editor** (Figure C-11) allows you to configure the default display properties of all plots you create. Properties you can configure include the border and background of the Viewport, the Title, Grid lines, Labels, Axis, Marker Lines, Legend, and miscellaneous properties of the plot window panel.

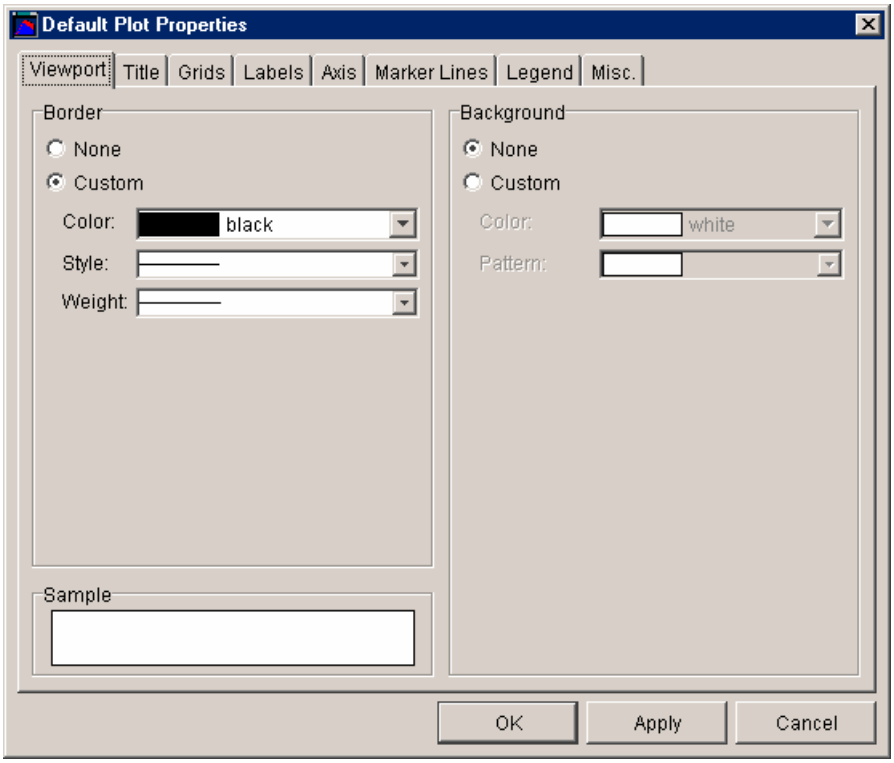


Figure C-11. Default Plot Properties Editor

When you customize plot properties using the Default Plot Properties Editor, your changes apply to all plots you create.

To access the Default Plot Properties Editor, from the **Edit** menu, click **Default Plot Properties**.

Customizing Plot Titles

You can add titles to individual plots and configure default properties for all plot titles.

To add or edit a title on an individual plot, you can either:

- From the **Edit** menu, choose **Plot Properties**. When the Plot Properties Editor opens, select the Title tab.

Or

- Right-click in the blank area above the plot (below the menu bar) with the Pointer Tool  , and then select **Edit Properties** from the shortcut menu (Figure C-12). The Title Properties Editor will open.

Figure C-12. Shortcut Menu--Title Properties

To specify the appearance of titles for all of your plots, from the **Edit** menu, click **Default Plot Properties**, then select the Title tab of the Default Plot Properties editor.

Whether you are using the Plot Properties Editor, the specialized Title Properties Editor, or the Default Plot Properties Editor, the worksheet for editing plot title properties is the same.

Figure C-13 shows the Title Properties Editor. This editor contains the same fields as the Title tab of the Plot Properties Editor and the Default Plot Properties Editor.

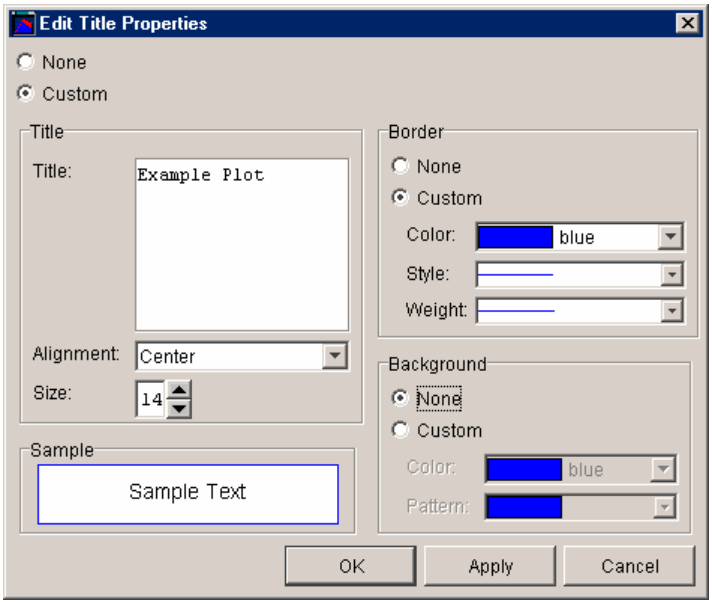


Figure C-13. Edit Title Properties

To specify a title for the plot, select Custom. In the Title panel, type the title you want in the Title box. From the Alignment list, select the alignment for the plot title. Your choices are Center, Left, or Right. From the Size list, select the text size for the title. The Sample box provides a preview of your plot title. The Border group allows you to add a border around the title. You can specify the Color, line Style, and line Weight. The Background group lets you add a background Color and/or Pattern behind your plot title. Click Apply to save your changes and continue adjusting the appearance of the title. Click OK when you are finished.

Customizing Curves

You can customize line and point styles, add labels, and specify symbols to indicate data quality in your plots. Additionally, you can specify the parameter-based default curve styles used across all plots.

There are three different ways to edit plot curves, depending on whether you wish to customize one or more curves in an individual plot or specify defaults for all plots.

Customizing Curves in Individual Plots

To customize all curves in an individual plot, from the **Edit** menu, choose **Plot Properties**. When the Plot Properties Editor opens, select the Curves tab.

To customize a specific curve in an individual plot, right-click on the line or curve you wish to edit with the Pointer Tool, then select **Edit Properties** from the shortcut menu (Figure C-14). The Edit Curve Properties Editor will open.

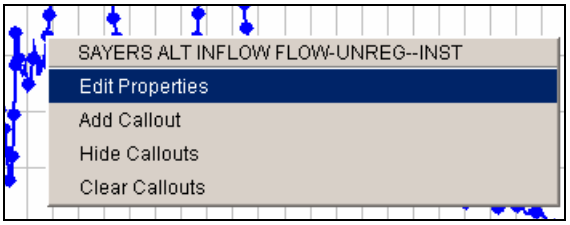


Figure C-14. Shortcut Menu--Curve Properties

The Curves tab of the Plot Properties Editor and the Edit Curve Properties Editor are nearly identical with two exceptions:

First, at the top of the Curves tab of the Plot Properties Editor, there is a list of all curves contained in the plot. In contrast, when you open the Edit Curve Properties Editor, it deals only with the curve you selected when you launched the editor; therefore, there is no list of curves.

Second, the Curves tab of the Plot Properties Editor has a Remove Line button, whereas the Edit Curve Properties Editor does not.

Despite these differences, both the Edit Curve Properties Editor and the Curves tab of the Plot Properties Editor allow you to edit Style, Label, and Quality Symbols. (You can edit Quality Symbols only if the plot has quality set for its data.)

Specifying Parameter-Based Default Curve Styles

To specify parameter-based default curve styles for all of your plots, from the Edit menu, click Default Line Styles. The Default Line Styles Options Editor will open (Figure C-10).

The Default Line Styles Options Editor gives you a way to edit line styles from the Line Styles box (Figure C-15). You can specify the default, parameter-based curve styles used for all plots.

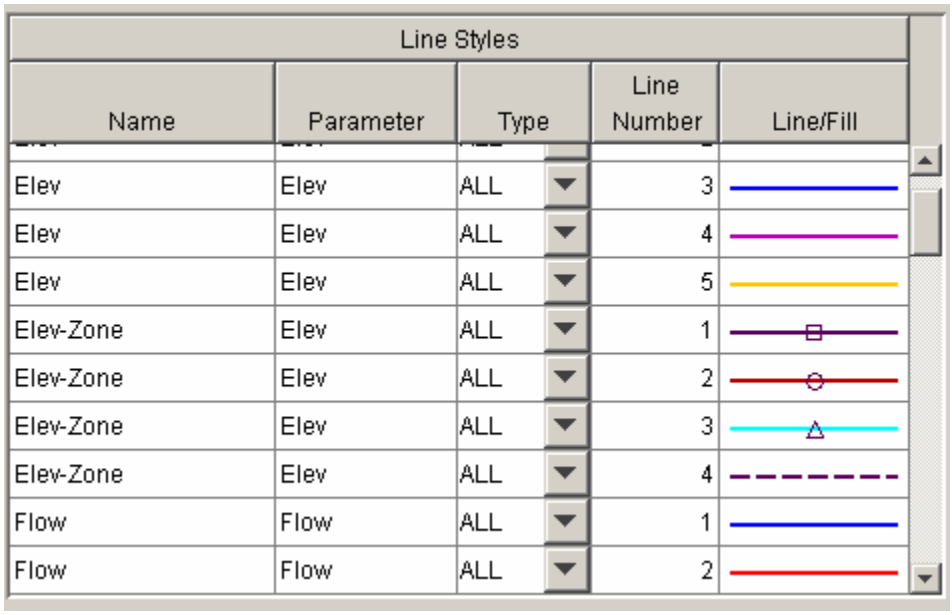


Figure C-15. Default Line Style Options Editor: Detail of Line Styles Box

The Line Styles box displays typical data types with default line and fill styles predefined.

You can edit all of these fields, change default line and fill styles for existing types, and add new data types to the list. At this time, there is no delete option.

Name and Parameter

To edit an existing name or parameter, highlight it, and then enter the new name or parameter. The name corresponds to the "C" part of HEC-DSS pathnames. The parameter associates data sets to be plotted in the same viewport. For example, FLOW-IN and FLOW-OUT are different "C" parts, but both are FLOW data sets and are to be plotted in the same viewport.

Type

To change the data type associated with a Name and Parameter, click the down-arrow and select from the list.

Line Number

The Line Number column indicates the number of lines associated with a data type. See Adding New Data Styles below.

Line/Fill

The Line/Fill property determines how curves associated with a particular name/parameter/type combination will appear in all plots. To specify the Line/Fill, select the row, and then customize the Line and Point properties.

Adding New Data Styles

To add a new data type:

From the **File** menu of the **Default Line Style Options Editor**, choose **New**. The New Data Type dialog box will open (Figure C-16).

Select a parameter from the Parameter list.

Enter a name in the Name box.

From the Type list, select the data type.

In the Number of Lines box, enter the number of curves you want to add for this new data type.

If you want to reverse the Y-axis, select Y Axis Reversed.

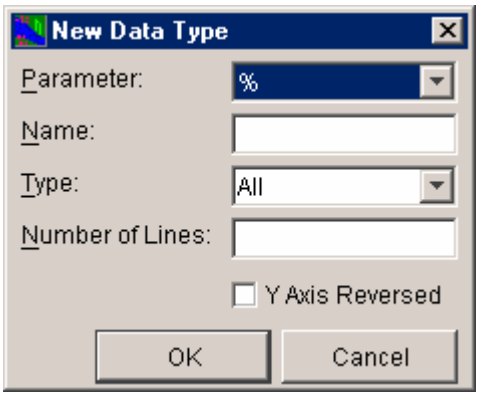


Figure C-16. New Data Type Dialog Box

Click OK to close the dialog box.

The Line Styles box will now display the new data type you have added, repeated as many times as you specified in the Number of Lines box (reflected in the Line Number column). You can customize the new data types as described above.

To save your changes, from the **File** menu, click **Save**. To close the Default Line Styles Options Editor, from the **File** menu, click **Close**.

Specifying Line and Point Styles of Curves

Figure C-17 shows the curve Line and Point Style worksheet. This worksheet is available from the Curves tabs of the Edit Curve Properties Editor, the Plot Properties Editor, and the Default Line Styles Options Editor.

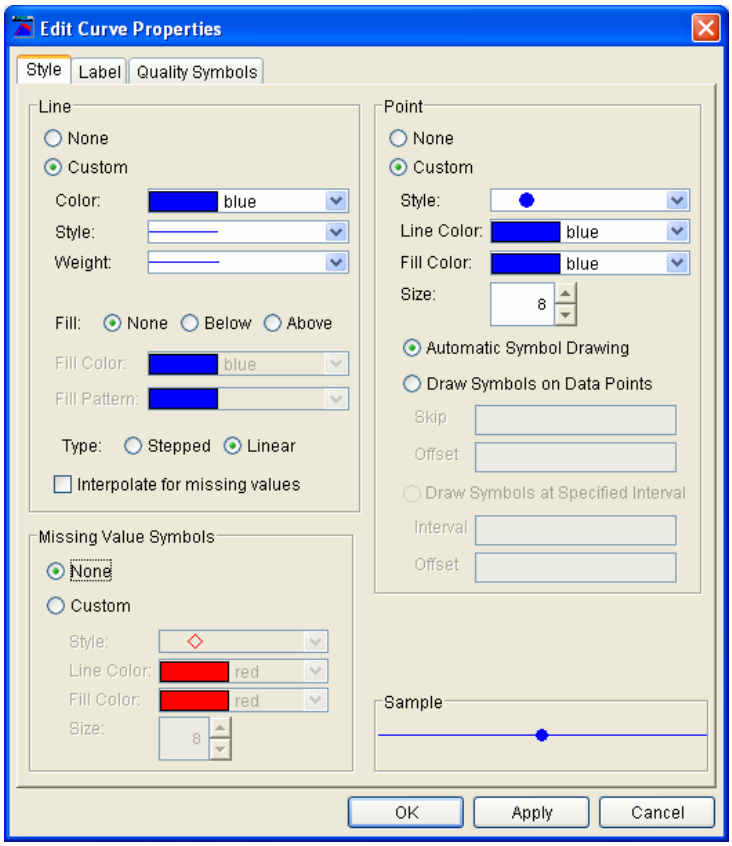


Figure C-17. Curve Line and Point Style Editing Interface

The Style tab has three main groups, Line, Point, and Missing Value Symbols which allow you to customize line and point styles, and a symbol that can be shown for missing values. Beneath the Point group, the Sample box provides a preview of the way your line and point choices will look.

To define line styles for curves:

1. In the Line group, click Custom.

2. Select the color, style, and weight you want for the line.

3. You can display lines with fill above or below, or without fill. Figure C-18 shows a plot with line fill below, whereas Figure C-19 shows the same plot without line fill.

4. Select if you want the curve drawn in a stair-stepped style, or linear with a line drawn directly between each point.

5. Select if you want a line drawn to interpolate where there are missing values.

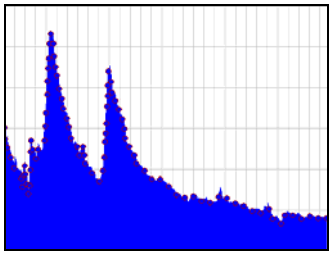


Figure C-18. Plot with Line Fill

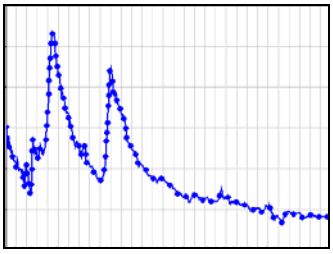


Figure C-19. Plot without Line Fill

To define point styles for curves:

1. In the Point group, click Custom.

2. Choose the Style, Line Color, and Fill Color you want. The Line Color is the "border" around the point symbol, whereas the Fill Color is the color inside the point symbol. Figure C-20 shows an example of a dark line color and a light fill color.

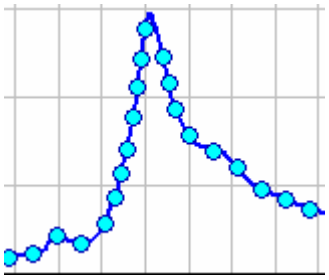


Figure C-20 Example Line and Fill Colors

3. In the Size box, specify the size of the point (in pixels) either by selecting a size from the list or by typing in a number from 1-45.

4. Automatic Symbol Drawing allows the plot to compute how to draw the points so they do not overlap. As you zoom in the plot will draw more points because you are increasing the distance between points. This will continue until all points on the curve are drawn.

5. Draw Symbols on Data Points allows you to specify how to draw the points so they don't overlap. If you set the Skip box to one (1), then it will draw one point, skip the next, then draw the third, etc. The Offset box allows you to say how many points on the curve to initially skip before drawing points.

6.

To define missing value symbols for curves:

1. In the Missing Value Symbol group, click Custom.

2. Choose the Style, Line Color, and Fill Color you want. The Line Color is the "border" around the point symbol, whereas the Fill Color is the color inside the point symbol. Figure 5.20 shows an example of a dark line color and a light fill color.

3. In the Size box, specify the size of the point (in pixels) either by selecting a size from the list or by typing in a number from 1-45.

4. This will place the selected symbol on each missing value.

Customizing Curve Labels

Figure C-21 shows the curve Label worksheet, available from the Curves tabs of the Edit Curve Properties Editor, the Plot Properties Editor, and the Default Line Styles Options Editor. This worksheet allows you to customize curve labels.

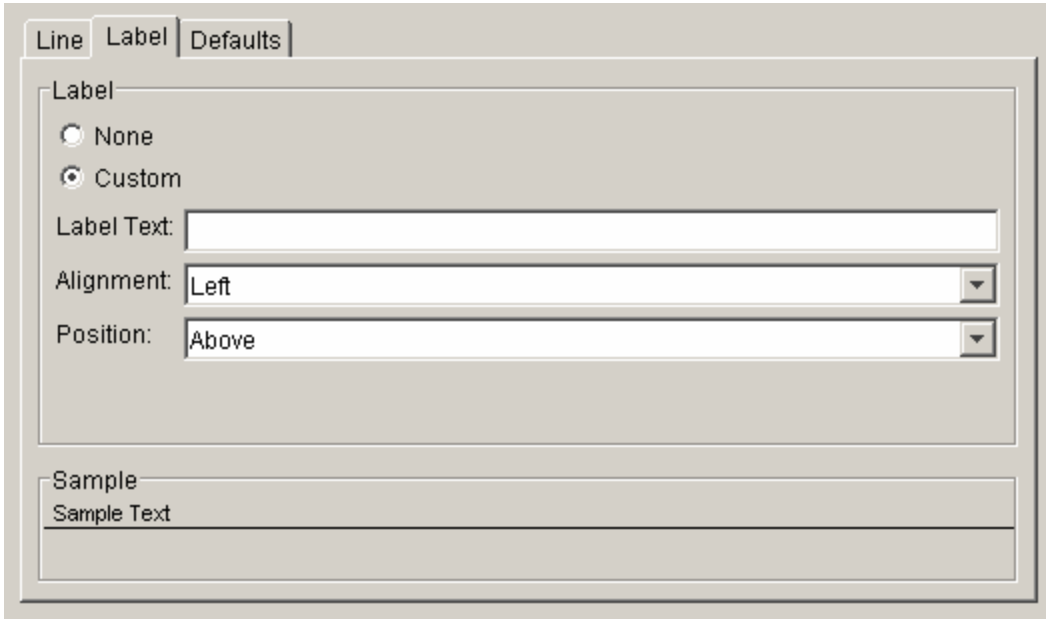


Figure C-21. Curve Label Editing Interface

To customize curve labels:

1. Select Custom.

2. Enter the text you want to appear in the curve label in the Label Text box.

3. In the Alignment list, click Left, Center, or Right to select the alignment of the curve label.

4. To set the position of the label, from the Position list, click Above, Center, or Below.

The Sample box provides a preview of the way your labels will look.

Customizing Curve Quality Symbols

Figure C-22 shows the curve Quality Symbols worksheet, available from the Curves tabs of the Edit Curve Properties Editor, the Plot Properties Editor, and the Default Line Styles Options Editor. This worksheet allows you to customize curves for plots that have quality set for their data.

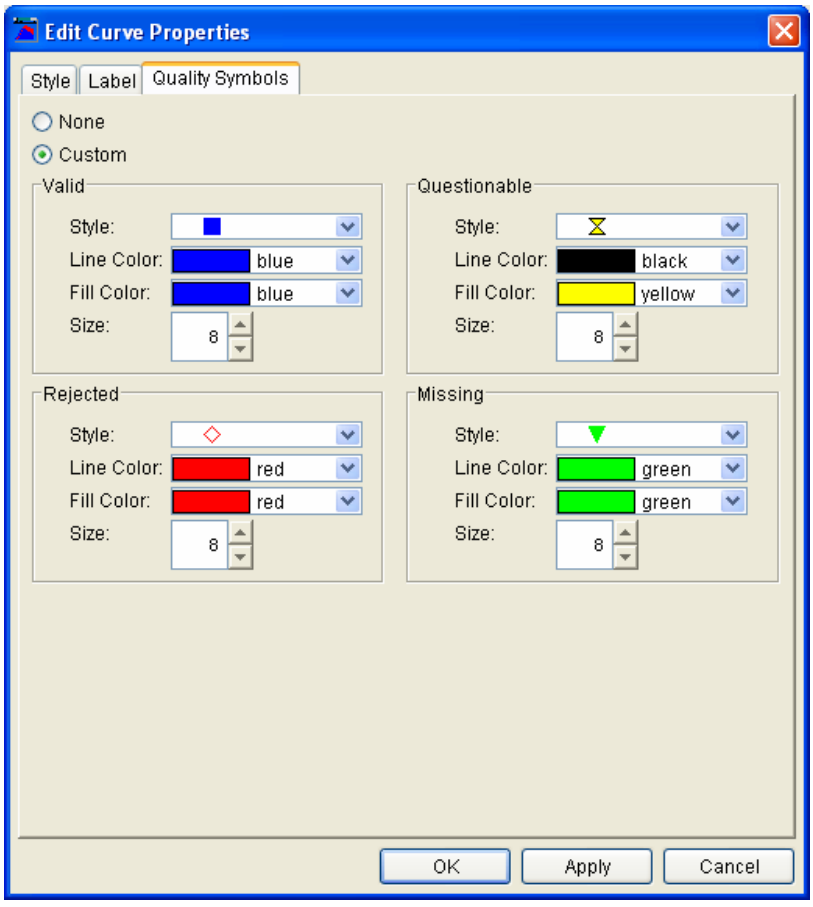


Figure C-22. Curve Quality Symbols Editing Interface

To customize quality symbols:

1. Choose Custom.
2. Select a symbol Style, Line Color, Fill Color, and Size for each quality of data.
3.

Customizing Viewport Properties

Viewports are the gridded areas in the plot window that contain plot curves. You can customize the border around the viewport, the background color and pattern, and the appearance of gridlines.

Customizing Viewport Borders and Background

To customize the borders and backgrounds of viewports in an individual plot, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the Patterns tab.

Or

Right-click in a blank area inside the viewport with the Pointer Tool  , and then select Edit Properties from the shortcut menu (Figure C-23). When the Viewport Properties Editor opens, select the Patterns tab.

Figure C-23. Shortcut Menu--Viewport Properties

To specify the default border and background of viewports for all of your plots, from the Edit menu, click Default Plot Properties. When the Default Plot Properties Editor opens, choose the Viewport tab.

Figure C-24 shows the Edit Viewport Properties Editor with the Patterns tab selected. This worksheet, accessed from the shortcut menu, contains the same items as the Patterns tab of the Plot Properties Editor and the Viewport tab of the Default Plot Properties Editor.

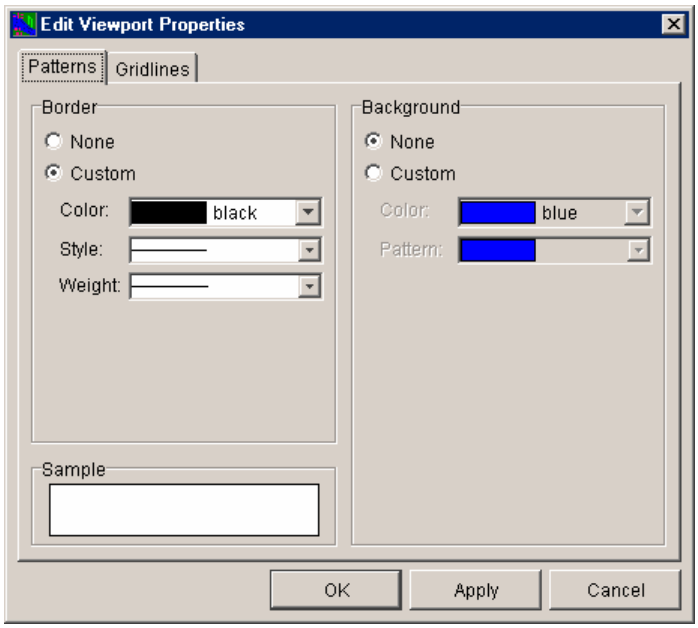


Figure C-24. Viewport Properties Editor-- Patterns Tab

The Patterns (or Viewport) tab has two main groups, Border and Background, which allow you to customize border and background of the viewport, respectively. Beneath the Border group, the Sample box provides a preview of the way the viewport border and background will look.

1. Select Custom in the Border group and choose the Color, Style, and Weight for the border you want to appear around the plot viewport.

2. Select Custom in the Background group and choose the Color and Pattern you want for the background.

Click Apply to save your changes and continue adjusting the appearance of the border and background. Click OK when you are finished.

Customizing Viewport Gridlines

To customize gridlines of viewports in an individual plot, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the Gridlines tab.

Or

Right-click in a blank area inside the viewport with the Pointer Tool  , and then select Edit Properties from the shortcut menu (Figure C-25). When the Viewport Properties Editor opens, select the Gridlines tab.

Figure C-25. Shortcut Menu--Viewport Properties

To specify viewport gridlines for all of your plots, from the **Edit** menu, select **Default Plot Properties**. When the Default Plot Properties Editor opens, choose the Grids tab.

Figure C- shows the Viewport Properties Editor with the Gridlines tab selected. This worksheet, accessed from the shortcut menu, contains the same items as the Gridlines tab of the Plot Properties Editor and the Grids tab of the Default Plot Properties Editor.

By default, the plot viewport displays gridlines only for the Major X Grid and Major Y Grid. The default color is light gray. To change the appearance of Major X and Y gridlines, select Custom and make your selections for Color, Style, and Weight.

By default, the Minor X Grid and Minor Y Grid are set to None and do not display in the plot viewport. If you want to display gridlines for the Minor X Grid and Minor Y Grid, select Custom and make your selections for Color, Style, and Weight.

Click Apply to view your changes without closing the editor. Click OK when you are finished.

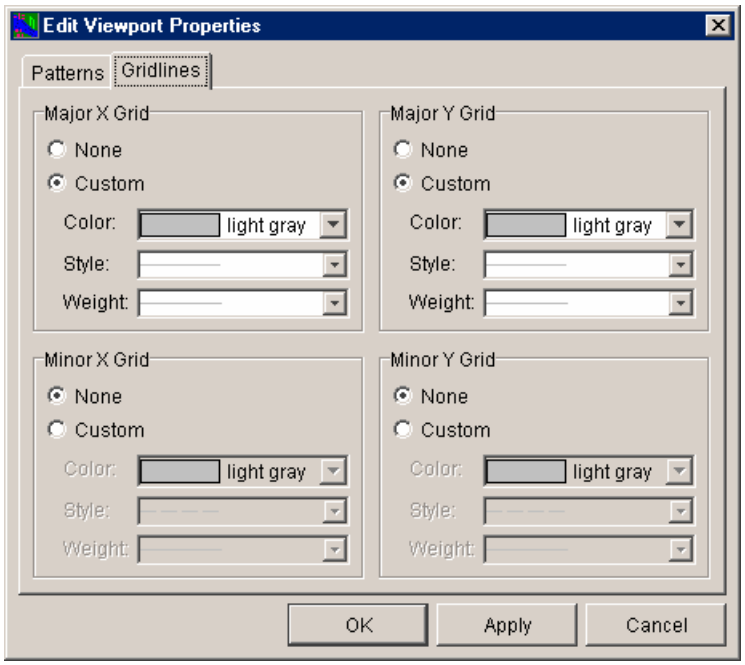


Figure C-26. Viewport Properties Editor-- Gridlines Tab

Adding and Customizing Marker Lines

You can add marker lines on your plot's X and Y axes and customize the appearance of these markers.

Adding Markers

To add a marker:

Right-click on the location in the plot where you want the marker to appear.

From the Viewport shortcut menu (Figure C-27), point to Add Marker, and then click either On X-Axis or On Y-Axis.

The marker will now appear in the plot.

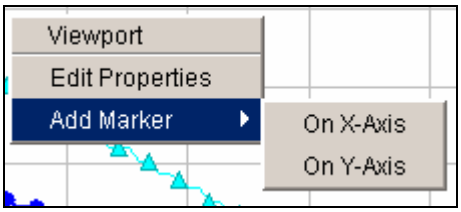


Figure C-27. Shortcut Menu: Add Marker

Deleting Markers

To delete a marker line in a plot, right click on it with the Pointer Tool  , and then click Delete from the Marker Line shortcut menu (Figure C-28).

Figure C-28. Shortcut Menu—Marker Line Properties

Customizing Markers

To edit the properties of a marker in an individual plot, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the Marker tab. This worksheet is available only if a marker exists in the plot. Choose the marker you want to edit from the Marker Lines list.

Or

With the Pointer Tool  , right-click on the marker you want to edit. From the Marker Line shortcut menu, select Edit Properties (Figure C-28). The Edit Marker Line Properties Editor will open.

To specify the default appearance of markers for all of your plots, from the **Edit** menu, click **Default Plot Properties**. When the Default Plot Properties Editor opens, choose the Marker Lines tab.

The interfaces for the specialized Edit Marker Line Editor and the Default Plot Properties Editor are very similar. However, the Plot Properties Editor interface differs in two ways. First, the Marker worksheet is available only if a marker exists in the current plot. Second, at the top of the editing panel there is a Marker Lines list containing all markers that exist in the current plot.

You can edit the line style and label of a marker using two editing tabs. Figure C-29 shows the Edit Marker Line Properties Editor with the Style worksheet selected, while Figure C-30 shows the Label/Value worksheet. The Marker Line tabs in the Plot Properties Editor and the Default Plot Properties Editor share the same two worksheets.

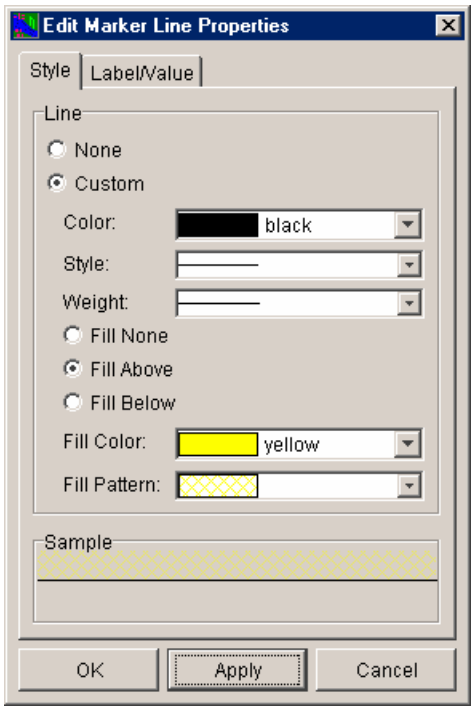


Figure C-29. Marker Line Properties Editor—Style Tab

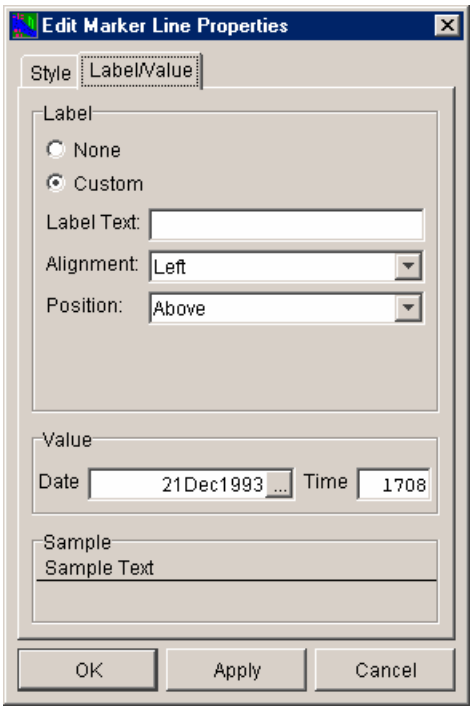


Figure C-30. Marker Line Properties Editor—Label/Value Tab

To edit the line style for markers:

1. Select the Style tab.
2. Choose Custom.
3. Select the Color, Style, and Weight for the marker line.

4. You can display marker lines with fill Above or Below, or without fill. Figure C-31 shows a plot with line Fill Above and a hatched pattern selected.

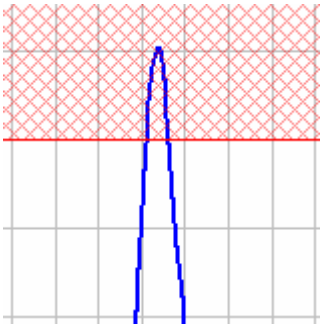


Figure C-31. Marker Line with Fill Above

The Sample box provides a preview of the way the marker line will look.

Click Apply to save your changes without closing the editor.

To add a label to a marker line:

1. Select the Label/Value tab.
2. Choose Custom.
3. In the Label Text box, enter the text you want to appear in the label.
4. From the Alignment list, select the justification of the label--Left, Center, or Right.
5. To set the position of the label, from the Position list, select either Above, Center, or Below.
6. For the Date value, enter the date in the format DDMMYYYY (e.g., 21Dec1993). You can also click the ... button to access the Calendar Tool (Figure C-32) to select the date.
7. For the Time value, enter the time in 24-hour military format (e.g., for 5:08 pm, enter “1708”).

Figure C-32. Calendar Tool

The Sample box provides a preview of the way the marker line will look.

Click Apply to save and view your changes without closing the editor. Click OK when you are finished editing marker line properties.

Editing Callouts

You can add descriptive callouts at specific points along a curve (Figure C-33). To do this:

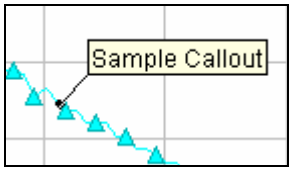


Figure C-33. Callout

Right-click on the location on the curve where you want the callout to appear.

From the shortcut menu (Figure C-34), point to Add Callout.

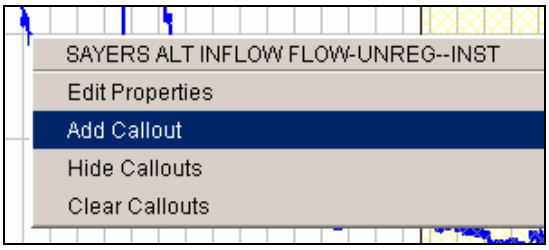


Figure C-34. Shortcut Menu: Add Callout

In the Add Callout dialog box (Figure C-35), enter the text you want to appear in the callout, and then click OK.

To hide all callouts in a plot, right-click on a curve in the plot. From the shortcut menu, click Hide Callouts.

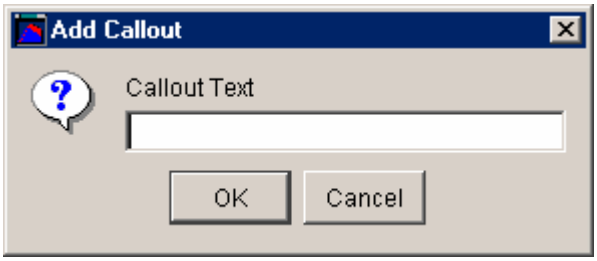


Figure C-35 Add Callout Dialog Box

Once you have hidden callouts, Hide Callouts in the shortcut menu changes to Show Callouts, allowing you to return callouts to the plot display.

To permanently remove all callouts from the plot, right-click on a curve in the plot to access the shortcut menu, then click Clear Callouts.

Customizing Axes

You can choose either a linear or log axis type, specify the axis scale, modify tic marks, and customize axis labels. Probability plots are generated for paired data sets with a type of "PROB", and cannot be changed without changing the data type.

Changing Axis Type

By default, plots display using a linear scale (Linear Axis), in which the axis increases and decreases by x. You can also use the log scale, which allows you to view curves that grow exponentially in a near straight line because the axis increases or decreases by the log (x). For example, you might wish to use the log scale when the axis has evenly-spaced major tics with values of 1,10,100,1000, and so on, such as in a performance history plot showing many years of data.

To change the axis type of an individual plot, right-click on an axis. From the Axis Tics shortcut menu, point to Set Axis Type, and then select the axis type from the submenu (Figure C-36). Depending on the axis type, you can click either Log Axis or Linear Axis.

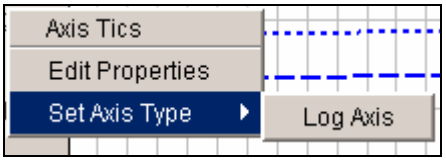


Figure C-36. Shortcut Menu - Set Axis Type

Specifying Axis Scale

You can specify the axis scale and tic interval for individual plots. To do this, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the **Axis tab**. From the Axis worksheet, select the axis you want to edit from the Axis list. Once you have this set, click the Scale tab to access the Scale worksheet.

Or

Right-click on the axis with the Pointer Tool  . From the Axis Tics shortcut menu (Figure C-37), click Edit Properties. When the Edit Axis Properties Editor opens, choose the Scale tab.

Figure C-37. Shortcut Menu—Axis Tics

Figure C-38 shows the Plot Properties Editor with the Axis tab selected and the Scale worksheet open. The Axis worksheets of the Plot Properties Editor and the Default Plot Properties Editor are nearly identical, except for the Axis list on the Plot Properties Editor. The Scale and Tics sub-worksheets are available in all three editors.

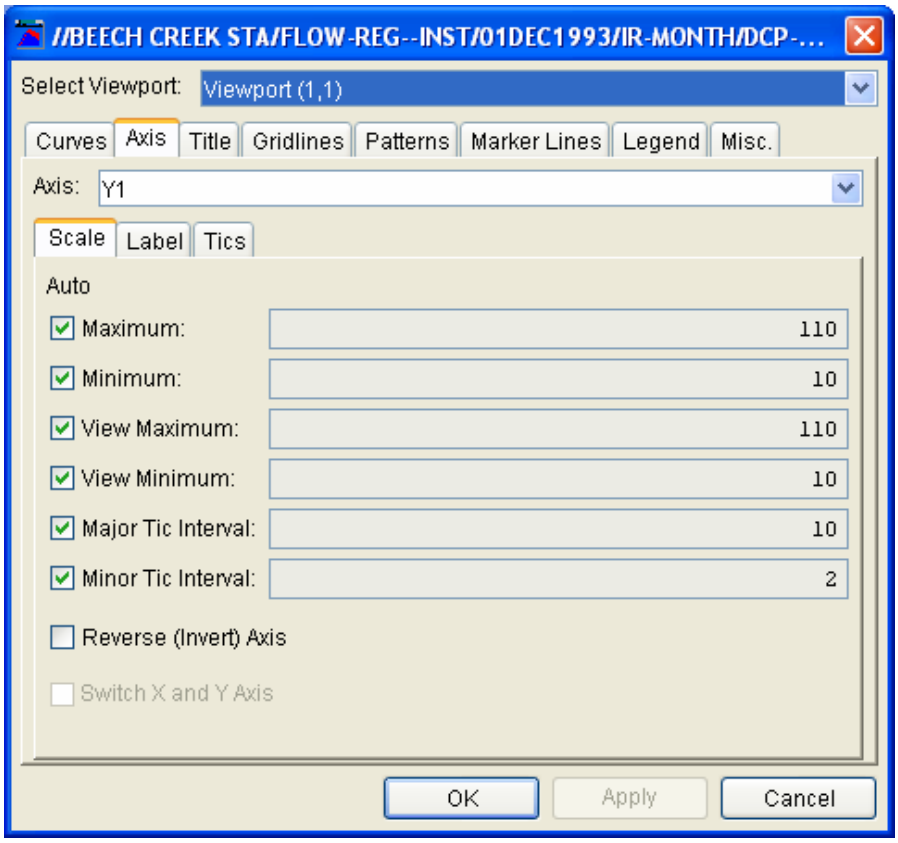


Figure C-38. Plot Properties Editor--Scale Worksheet

With the Scale worksheet, you can specify the range of the scale, the amount of the scale that is visible, and the tic intervals.

If the Auto box is checked, the plot will automatically select the scale. Otherwise, as you zoom in and out of the plot, its view values change while the minimum and maximum scale range values remain fixed:

- **Maximum**: enter the value of the maximum range of the scale.
- **Minimum**: enter the value of the minimum range of the scale.
- **View Maximum**: enter the maximum visible range of the scale.
- **View Minimum**: enter the minimum visible range of the scale.

Tic intervals are the distances between tics on the axis scale:

- **Major Tic Interval**: specify the distance between each major tic.

- **Minor Tic Interval**: specify a value less than or equal to the major tic value.

You can also choose to reverse the axis and invert the data by selecting Reverse (Invert) Axis. If the data set is paired, you can switch the X and Y axis, so what is plotted on the X axis becomes plotted on the Y axis instead.

Click **Apply** to save and view your changes without closing the editor.

Click **OK** to save your changes and close the editor.

Modifying Tic Marks

You can modify the color of tic marks, choose whether or not major and minor tic marks display, and specify whether labels display.

To modify tic marks in an individual plot, you can either:

- From the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Axis tab. From the Axis worksheet, select the axis you want to edit from the Axis list. Once you have this set, choose the Tics tab to set tic marks.

Or

- Right-click on the axis with the Pointer Tool  . From the Axis Tics shortcut menu (Figure C-37), click Edit Properties. When the Edit Axis Properties Editor opens, choose the Tics tab.

To specify default settings for axis tics in all of your plots, click Default Plot Properties from the plot Edit menu. When the Default Plot Properties Editor opens, choose the Axis tab, then the Tics tab.

Figure C-39 shows the Tics worksheet of the Edit Axis Properties Editor. The Tics worksheet is nearly identical on the Edit Axis Properties Editor, Plot Properties Editor, and Default Plot Properties Editor. However, at the top of the Plot Properties Editor is an Axis list containing all of the axes available for editing in the current plot. In the Plot Properties Editor, you must choose an axis to edit before you can make any changes.

By default, plot axes display major tic marks with labels. To turn off these options, click to clear the Use major tick marks and Use tick mark labels check boxes.

You can also select Use minor tic marks.

To change tic color, select the color you want from the Tic Color list.

Click Apply to save and view changes without closing the editor.

Click OK to save your changes and close the editor.

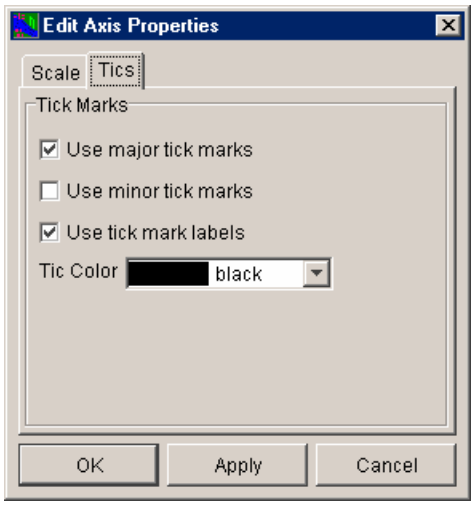


Figure C-39. Axis Properties Editor--Tics Tab

Customizing Axis Labels

You can add borders and backgrounds to axis labels.

To customize axis labels in an individual plot, you can either:

- From the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Axis tab. On the Axis worksheet, select the axis you want to edit from the Axis list. Once you have this set, select the Label tab to set axis label properties.

Or

- Right-click on the axis label with the Pointer Tool. From the G2d Label shortcut menu (Figure C-40), click Edit Properties. The Edit Label Properties Editor will open.

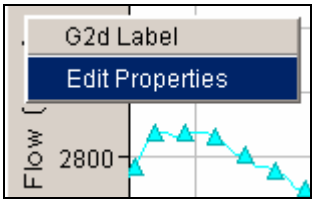


Figure C-40. G2d Label Shortcut Menu

To specify default settings for axis labels in all of your plots, select Default Plot Properties from the plot Edit menu. When the Default Plot Properties Editor opens, choose the Axis tab, then the Label tab.

Figure C-41 shows the Edit Label Properties Editor. The same worksheet is available on the Label tabs of the Plot Properties Editor and Default Plot Properties Editor, with one difference. The Plot

Properties Editor has an Axis list containing all of the axes available for editing in the current plot.

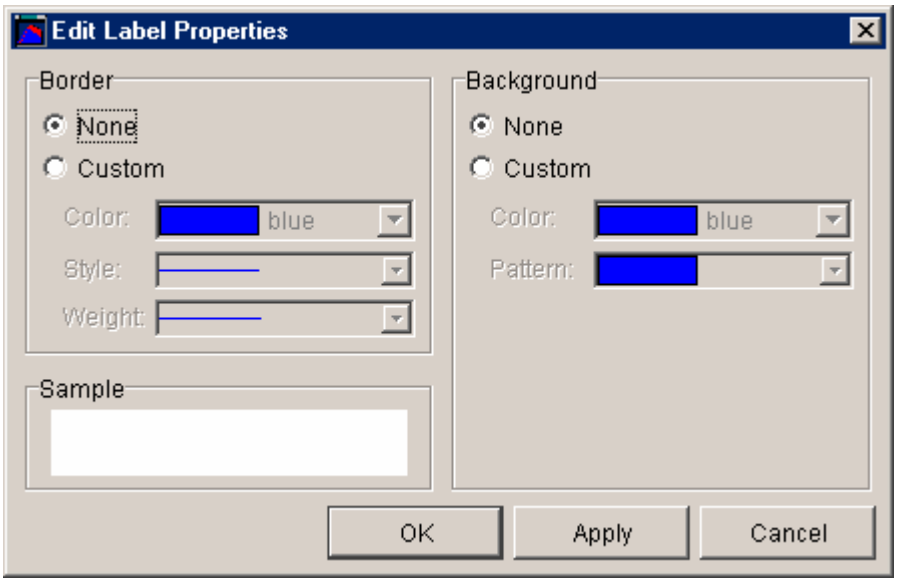


Figure C-41. Label Properties Editor

The Label worksheet has two groups, Border and Background, which allow you to customize border and background of the label, respectively. Beneath the Border group, the Sample box provides a preview of the label.

To add a border around the axis label, choose Custom in the Border group, and then select the Color, Style, and Weight for the borderline.

To add a background to the axis label, choose Custom in the Background group, and then select a Color and Pattern.

Click Apply to save and view your changes without closing the editor. Click OK when you are finished editing axis label properties.

Customizing Legends

As Figure C-42 illustrates, you can add titles to the top of plot legends and add text and graphics to the right and left sides. You can also specify whether the legend appears below or to the right of the plot.

Figure C-42. Customizing Legends

To add legend labels to an individual plot, you can either:

- From the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Legend tab.

Or

- Right-click in a blank area inside the legend panel of the plot with the Pointer Tool. From the Legend Panel shortcut menu (Figure C-43), click Edit Properties. The Edit Legend Properties Editor will open.

Figure C-43. Shortcut Menu - Legend Panel

To specify default settings for all of your plot legends, from the Edit menu, click Default Plot Properties. When the Default Plot Properties Editor opens, choose the Legend tab.

Whether you are using the Plot Properties Editor, Edit Legend Properties Editor, or Default Plot Properties Editor, the worksheet for editing legend titles is the same.

Figure C-44 shows the Legend Properties Editor. This worksheet, accessed from the shortcut menu, contains the same fields as the Legend worksheets of both the Plot Properties Editor and the Default Plot Properties Editor.

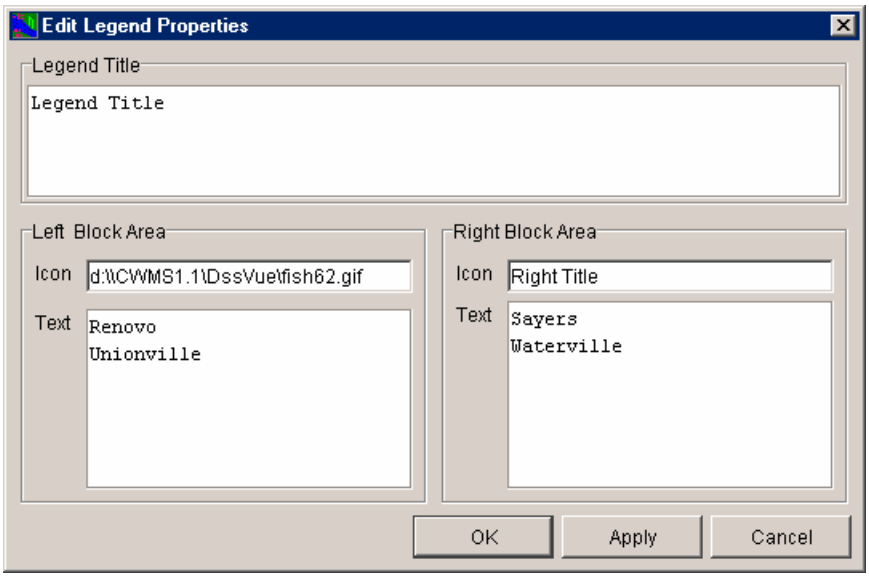


Figure C-44. Legend Properties Editor

In the Legend Title box, enter the title you want to appear along the top of the legend box.

In the Left Block Area and Right Block Area groups, you can specify the Icon and Text you want to appear on either side of the legend block.

If you wish to display icons, type the exact paths and filenames of the icon in the Icon field. (The path is the location on your computer.)

Enter any text you want to display in the Text boxes.

Click Apply to view your changes without closing the editor. Click OK to save your changes and close the editor.

Customizing Window Panels

You can customize the color and spacing of the window "panel" in which plots are displayed; you can also choose whether the plot legend displays horizontally along the bottom of the plot panel or vertically along the right side.

To customize panel properties of an individual plot, from the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Misc. tab.

To specify panel properties for all of your plots, from the Edit menu, click Default Plot Properties. When the Default Plot Properties Editor opens, choose the Misc. tab.

Whether you are using the Plot Properties Editor or the Default Plot Properties Editor, the Misc. worksheet is the same. Figure C-45 shows the Misc. worksheet of the Default Plot Properties Editor.

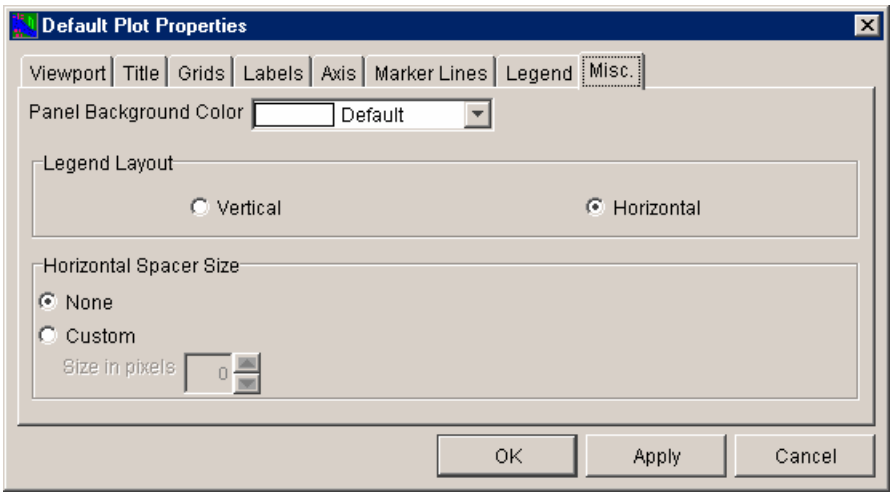


Figure C-45. Default Plot Properties Editor--Misc. Tab

You can also edit the legend layout and spacer size from individual property editors accessed from shortcut menus, as discussed below.

Customizing the Panel Background Color

To customize the panel background color, click the down arrow beside the Panel Background Color field to select the color you want. There is no individual property editor available for customizing the panel background color.

Customizing the Legend Layout

If you want the plot legend to display horizontally along the bottom of the plot panel, in the Legend Layout group, select Horizontal. If you want the plot legend to display vertically along the right side of the plot panel, select Vertical.

Another way to adjust the position of the legend for an individual plot is to use the Legend Panel shortcut menu (Figure C-46).

To access the Legend Panel shortcut menu, with the pointer tool right-click on a blank area inside of the legend panel in the plot window panel. If the legend is currently positioned horizontally, you can click Move To Right, which will cause the legend to display vertically. If the legend is currently positioned vertically, you can click Move to Bottom, which will cause the legend to display horizontally.

Figure C-46 Legend Panel Shortcut Menu

Customizing the Horizontal Spacer Size

In the Plot Properties Editor and Default Plot Properties Editor, horizontal spacer size refers to the space between viewports in plots with multiple viewports. In single-viewport plots, it is the "margin" space between the right side of the viewport and the edge of the window panel.

To specify the horizontal spacer size using the Misc. tab of the Plot Properties Editor or Default Plot Properties Editor, in the Horizontal Spacer Size group, select Custom, then either select the pixel size from the list or enter a value less than 50.

You can also use the Spacer shortcut menu (Figure C-47) to customize both horizontal and vertical spacer size for an individual plot.

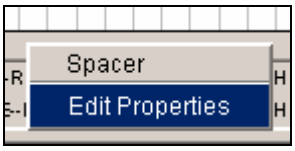


Figure C-47. Spacer Shortcut Menu

To access the Spacer shortcut menu, right-click on a blank space on the plot panel. Click between viewports if you want to adjust vertical spacing between viewports, or to the right of a viewport to adjust horizontal spacing.

From the Spacer shortcut menu, click Edit Properties. The Edit Spacer Properties dialog box will open (Figure C-48).

Figure C-48. Edit Spacer Properties Dialog Box

To specify the spacer size, enter a value less than 50.

Customizing Plot Layout

The Configure Plot Editor (Figure C-49) displays plot components in a "tree" structure and allows you to customize the layout of an individual plot. You can add and remove axes as well as add, remove, arrange the order of, and set the weight of viewports in the plot window panel.

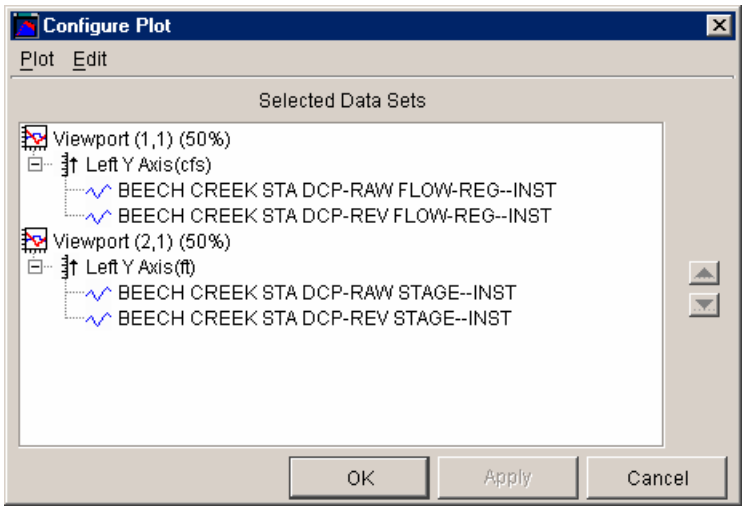


Figure C-49. Configure Plot Editor

When you customize the layout of a plot using the Configure Plot Editor, your changes apply only to that individual plot unless you export the plot's properties.

To access the Configure Plot Editor, from the Edit menu, select Configure Plot Layout.

Adding and Removing Viewports

To add a new viewport to a plot, from the Configure Plot Editor's Edit menu click Add Viewport. The new viewport will appear at the bottom of the "tree" in the Selected Data Sets box.

To remove a viewport, you can either:

- Click on the name of the viewport in the Selected Data Sets "tree." From the Edit menu, click Remove Viewport.

Or

- Right-click on the viewport's name in the Selected Data Sets "tree." From the shortcut menu (Figure C-50), click Remove.

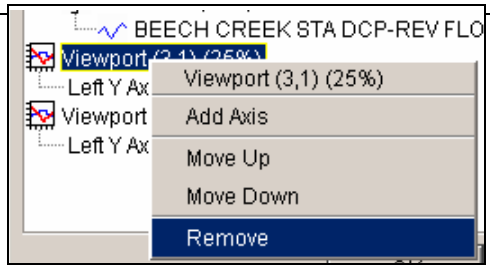


Figure C-50. Shortcut Menu--Remove Viewport

Setting Viewport Weights

You can customize the relative sizes of viewports in your plots. To do this:

1. From the Edit menu of the Configure Plot Layout Editor, click Set Viewport Weights. The Set Plot Viewport Weights dialog box will open.

2. In the Set Plot Viewport Weights dialog box (Figure C-51), you can specify the relative size of each viewport as a percentage value, with all of the weights adding up to 100%. Figure C-51 shows four viewports of equal weight at 25% each.

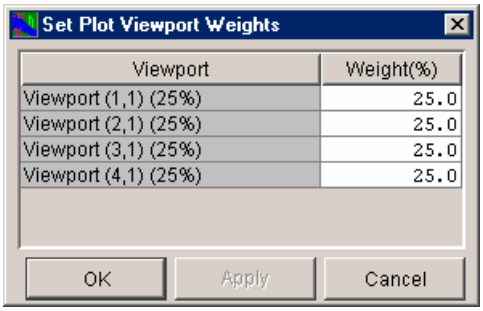


Figure C-51. Set Plot Viewport Weights Dialog Box

Note that the Set Plot Viewport Weights dialog box offers the same right-click shortcut menu commands as are available in all tables. You can cut, copy, and paste data cells; insert, append, and delete rows; and print and export. For more information, refer to the section on tabular data in the Utilities chapter.

Click Apply to save and view your changes without closing the dialog box. Click OK to save your changes and close the dialog box.

Adding and Removing Axes

By default, viewports have a left Y-axis. You can also add a right Y-axis, remove both the left and right Y-axes, and add a new left Y-axis if you have previously removed it. Viewports can have a maximum of

two axes, and you cannot remove an axis when a data set is associated with it.

To add an axis to a viewport, you can either:

- Click on the viewport's name in the tree in the Selected Data Sets box. From the Edit menu, choose Add Axis.

Or

- Right-click on the viewport's name in the tree in the Selected Data Sets. From the shortcut menu (Figure C-52), click Add Axis.

The tree now displays another axis for the viewport you selected.

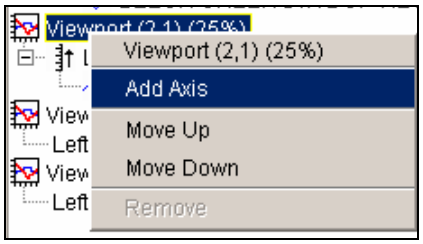


Figure C-52. Shortcut Menu - Add Axis

To remove an axis that has no data associated with it, you can either:

- Click on the name of the axis you wish to remove in the tree in the Selected Data Sets box. From the Edit menu, click Remove Axis.

Or

- Right-click on the axis you wish to remove in the tree in the Selected Data Sets box. From the shortcut menu, click Remove.

The selected axis will no longer display in the tree.

Arranging Viewports and Axes

You can rearrange the vertical order of viewports in a plot window and move axes (with their associated data sets) to different viewports.

To move a viewport or axis,

1. From the tree in the Selected Data Sets box, right-click on the name of a viewport or axis you want to move.

2. From the shortcut menu, click Move Up or Move Down from the shortcut menu.

3. Either click OK or Apply for the change to take effect in the plot window.

Note that you cannot move individual data sets in the Configure Plot Layout Editor. You can move only the axis with which a data set is associated.

Reversing Axes (Invert Data)

To reverse the direction of an axis so that the data is inverted, right-click on the name of the axis in the tree. From the shortcut menu, click Reverse. Either click OK or Apply for the change to appear in the plot window.

Exporting and Importing Templates

After you have customized a plot, you can save its settings as a template for use in other plots.

Generally, you will use templates when scripting plots. For example, every day you generate a plot of flow, stage, and precipitation via a script, and then apply a template that has all of the correct formatting, such as viewport placement, size, line colors, and fills. For more information about using templates with scripts, refer to the chapter on Scripting.

To create a template from a plot:

1. From the File menu, click Export Properties.
2. From the Export Plot Template dialog box (Figure C-53), specify whether you want the template to be available for All Applications or This Watershed only, and then give the template a Name.
3. Click OK to save the template and close the dialog box.

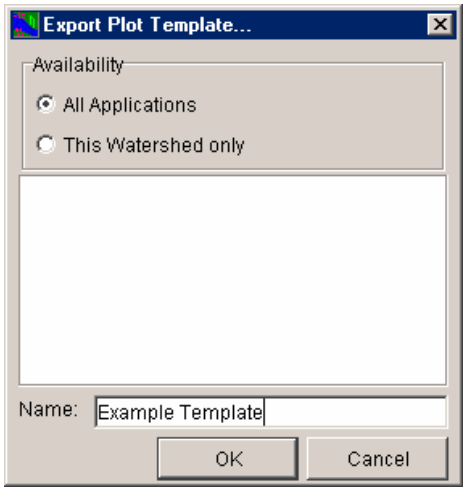


Figure C-53. Export Plot Template Dialog Box

To apply (import) a template you have created to another plot currently open:

1. From the File menu, click Import Properties.

2. In the Import Plot Template dialog box (Figure C-54), specify whether you want to use a template available for All Applications or for This Watershed only.

3. A list of available templates will display. Choose the template you want by clicking on its name.

4. When you select a template, its name will display in the Name field.

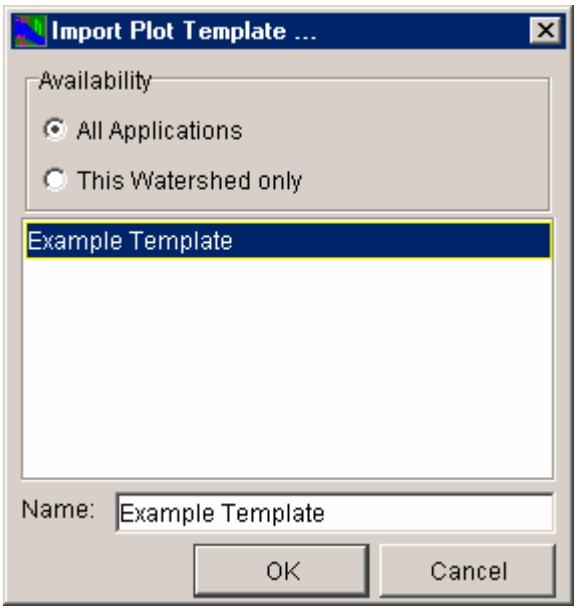


Figure C-54. Import Plot Template Dialog Box

5. Click OK to apply the template to the current plot and close the dialog box.

Additional Viewing Options for Plots

The File menu of plots (Figure C-55) contains several commands that allow you to view plot data in tabular form, save plots, and copy and paste plots into other applications such as Microsoft Word, Excel, and Visio.

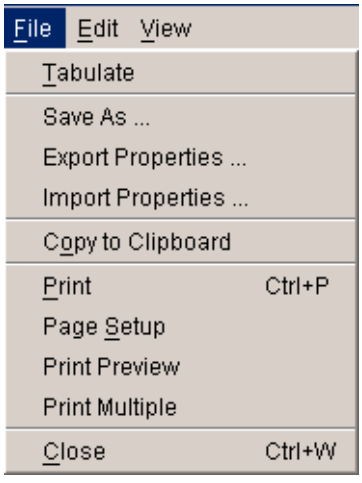
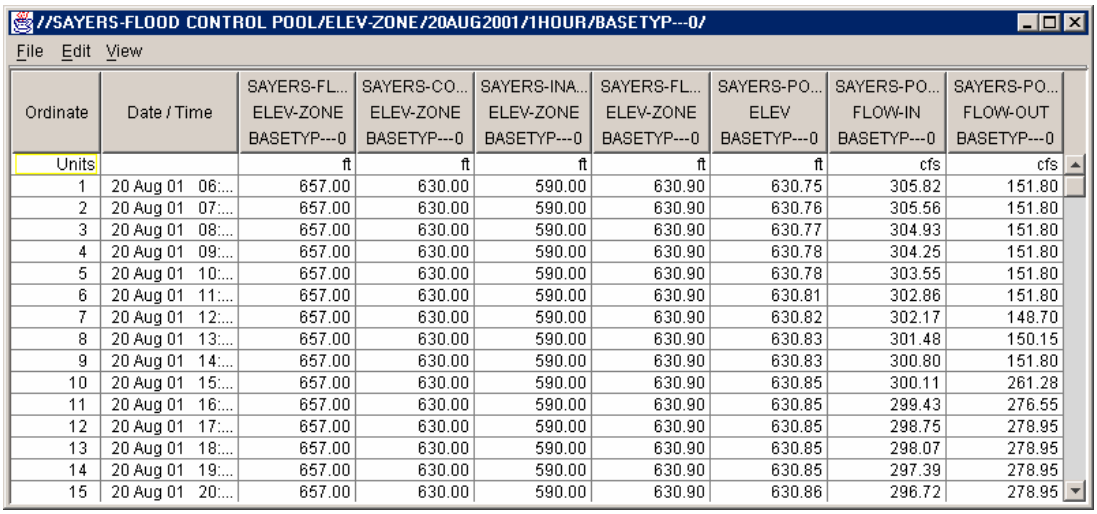


Figure C-55. File Menu

Viewing Data in Tabular Form

To view plot data in tabular form, from the File menu, click Tabulate. A dialog box will open displaying the data in tabular form (Figure C-56).



//SAYERS-FLOOD CONTROL POOL/ELEV-ZONE/20AUG2001/1HOUR/BASETYP---0/

File Edit View

Ordinate	Date / Time	SAYERS-FL... ELEV-ZONE BASETYP---0	SAYERS-CO... ELEV-ZONE BASETYP---0	SAYERS-INA... ELEV-ZONE BASETYP---0	SAYERS-FL... ELEV-ZONE BASETYP---0	SAYERS-PO... ELEV BASETYP---0	SAYERS-PO... FLOW-IN BASETYP---0	SAYERS-PO... FLOW-OUT BASETYP---0
Units		ft	ft	ft	ft	ft	cfs	cfs
1	20 Aug 01 06:...	657.00	630.00	590.00	630.90	630.75	305.82	151.80
2	20 Aug 01 07:...	657.00	630.00	590.00	630.90	630.76	305.56	151.80
3	20 Aug 01 08:...	657.00	630.00	590.00	630.90	630.77	304.93	151.80
4	20 Aug 01 09:...	657.00	630.00	590.00	630.90	630.78	304.25	151.80
5	20 Aug 01 10:...	657.00	630.00	590.00	630.90	630.78	303.55	151.80
6	20 Aug 01 11:...	657.00	630.00	590.00	630.90	630.81	302.86	151.80
7	20 Aug 01 12:...	657.00	630.00	590.00	630.90	630.82	302.17	148.70
8	20 Aug 01 13:...	657.00	630.00	590.00	630.90	630.83	301.48	150.15
9	20 Aug 01 14:...	657.00	630.00	590.00	630.90	630.83	300.80	151.80
10	20 Aug 01 15:...	657.00	630.00	590.00	630.90	630.85	300.11	261.28
11	20 Aug 01 16:...	657.00	630.00	590.00	630.90	630.85	299.43	276.55
12	20 Aug 01 17:...	657.00	630.00	590.00	630.90	630.85	298.75	278.95
13	20 Aug 01 18:...	657.00	630.00	590.00	630.90	630.85	298.07	278.95
14	20 Aug 01 19:...	657.00	630.00	590.00	630.90	630.85	297.39	278.95
15	20 Aug 01 20:...	657.00	630.00	590.00	630.90	630.86	296.72	278.95

Figure C-56. Data in Tabular Form

For more information about tables, refer to the chapter on Utilities.

Saving Plots

You can save a plot as an image (JPEG), a Windows Metafile (*.wmf), as Portable Network Graphics (*.png), or other formats.

To do this, from the File menu, click Save As. From the Save dialog box (Figure C-57), select the location where you want to save the plot, enter a filename in the File name box, and select the file type you want from the Files of type list, then click Save.

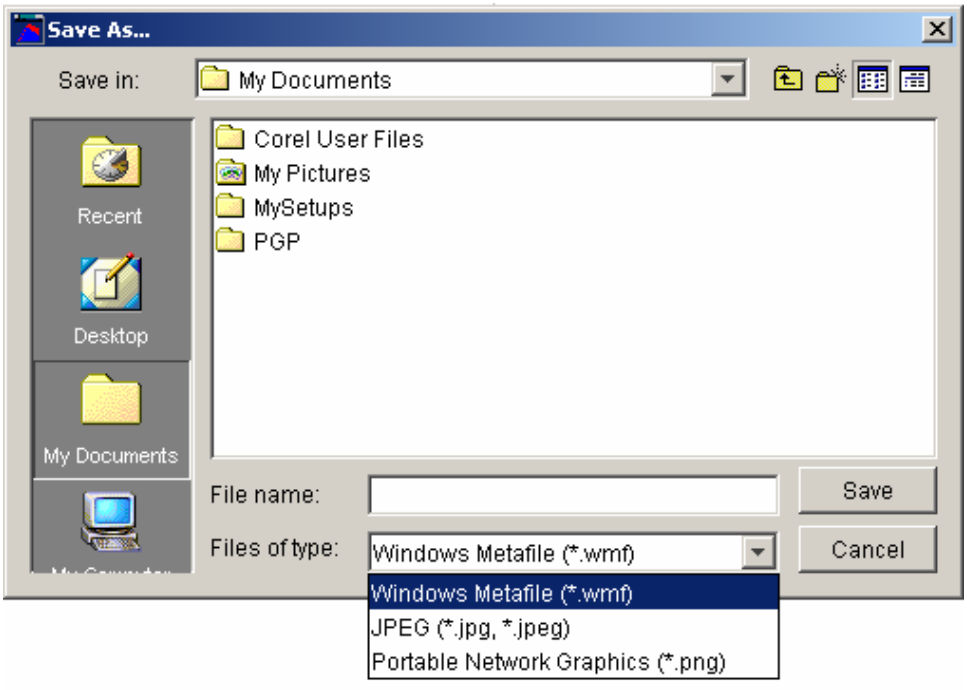


Figure C-57. Save Dialog Box

Copying Plots to the Clipboard

Use Copy to Clipboard from the File menu to copy a plot to the clipboard. You can then paste the plot as an image into another application such as Microsoft Word, Excel, or Visio.

Printing Plots

The Print command, available from the File menu of plots, opens a standard, Windows-style print dialog box.

From the File menu, click Page Setup. The Page Setup dialog box will open (Figure C-58). Here you can set the page Orientation, Page Margins, Page Numbers, and Printer Scale.

Set Margins opens the Printer Margins dialog box (Figure C-59).

Figure C-58. Page Setup Dialog Box

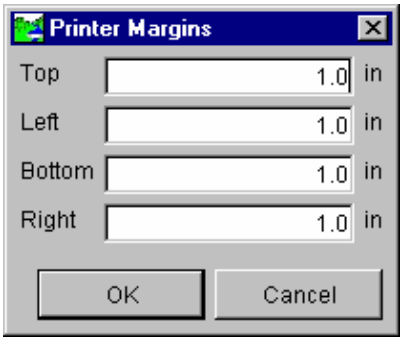


Figure C-59. Printer Margins Dialog Box

To view the plot as it will be printed, from the File menu, click Print Preview. Figure C-60 shows an example.

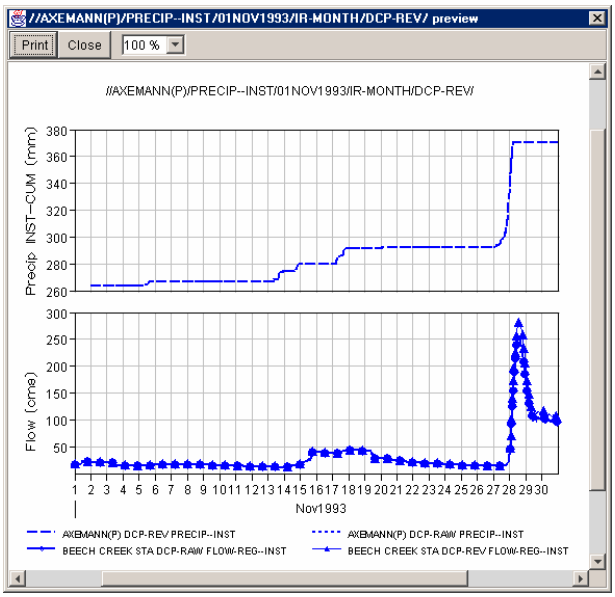


Figure C-60. Example Print Preview of a Plot

Finally, the Print Multiple command allows you to print several plots on one page. The Print Multiple dialog box (Figure C-61) shows all of the currently open plots in the Available Plots box. To select plots for printing, double-click on the plots in the Available Plots box and the selected plots will move to the Selected Plots box.

Next, use the slider bars to specify the number of plots you wish to appear horizontally and vertically on the page. The grid to the right of the sliders reflects your choices.

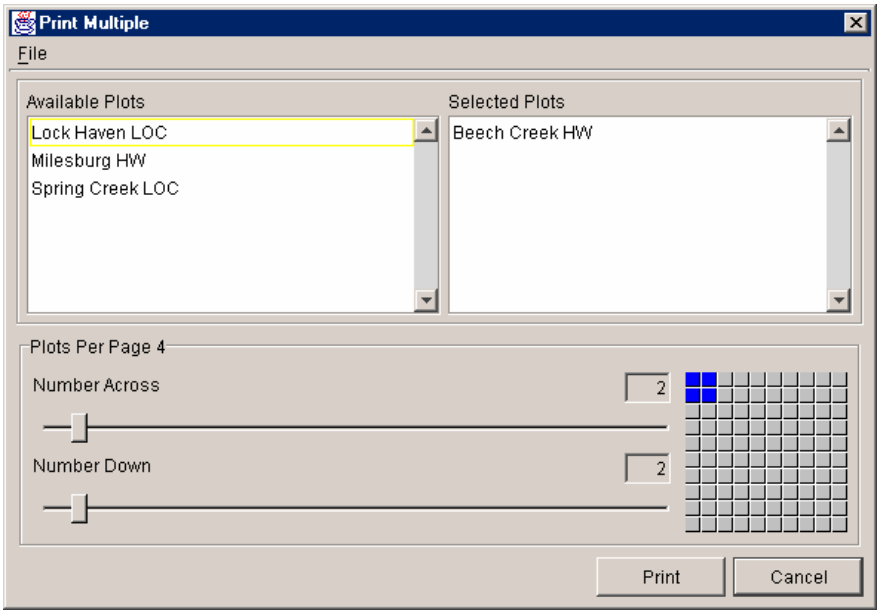


Figure C-61. Print Multiple Dialog Box

Figure C-62 shows a preview of the plots set up above. From the Print Multiple dialog box, you can also use the Page Setup and Print Preview commands. The two commands are available from the File menu of the Print Multiple dialog box.

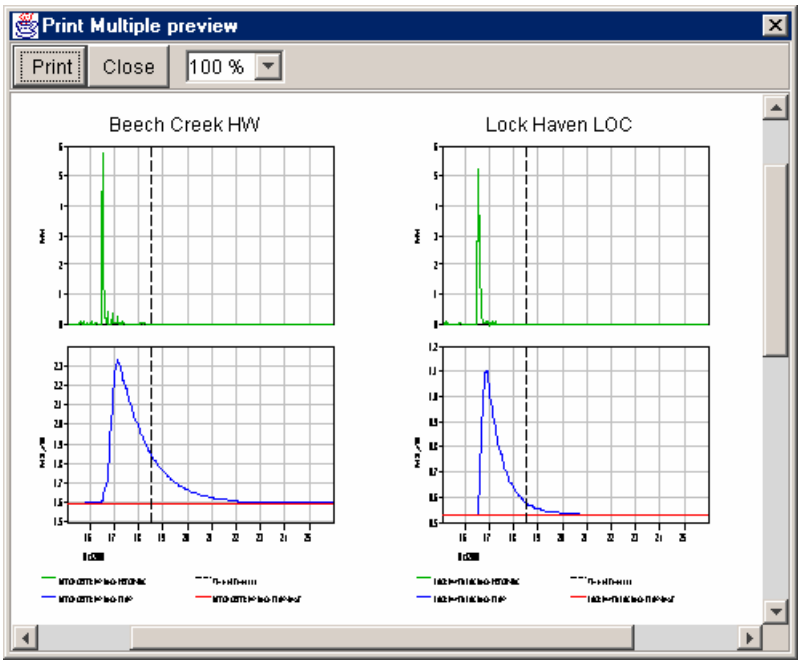


Figure C-62. Print Multiple Preview Dialog Box (Example)